The “Precast Concrete Bent Cap Option” Standards

Courtney Holle, P.E.
TxDOT
Bridge Division

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - Do’s and Don’ts
  - Location of Standard Drawings
- Questions

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Background

- Round Columns posted in April 2011
- Piles posted in January 2012
- Optional construction methods (Not mandatory)
- Based on Research Projects
  - 1748 “Development of a Precast Bent Cap System”
  - 4176 “Anchorage for Grouted Vertical-Duct Connectors in Precast Bent Cap Systems”
- Benefits
  - Accelerated Bridge Construction (ABC)
  - Increases construction zone safety
  - Contractor’s Choice ~ Precast vs. Cast-In-Place

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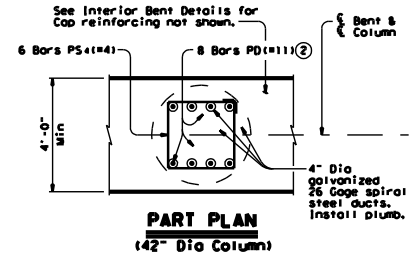

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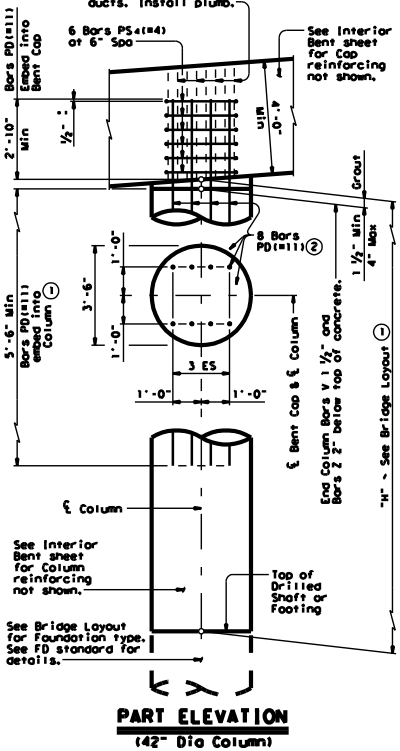

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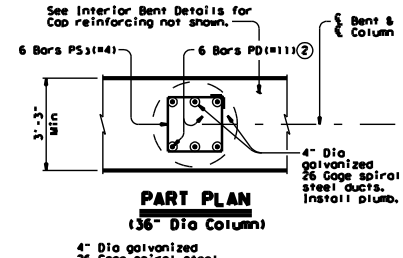

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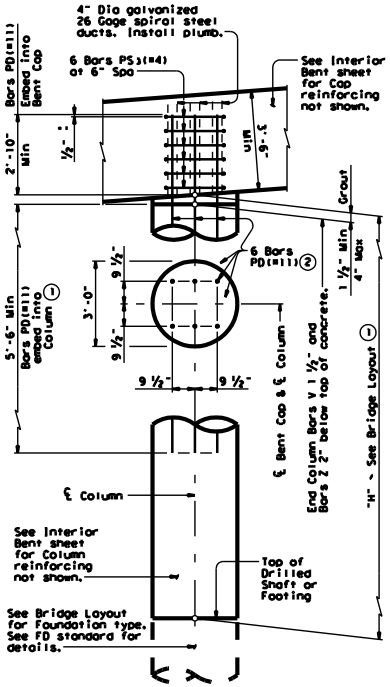

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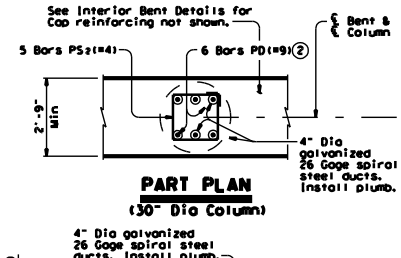

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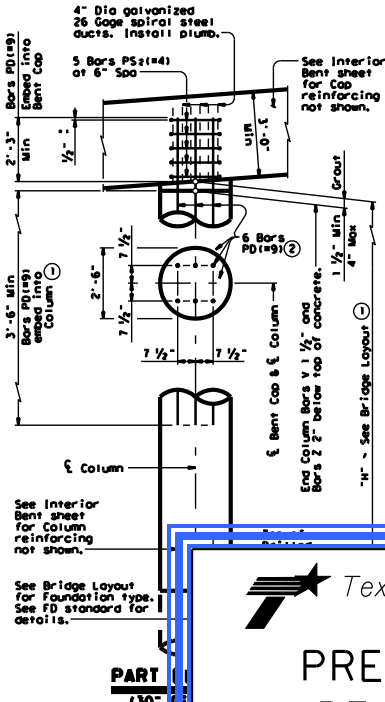

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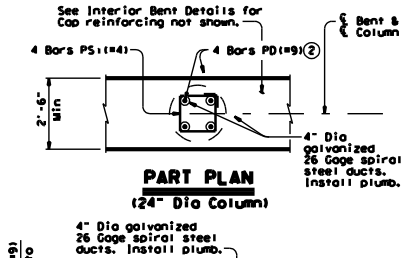

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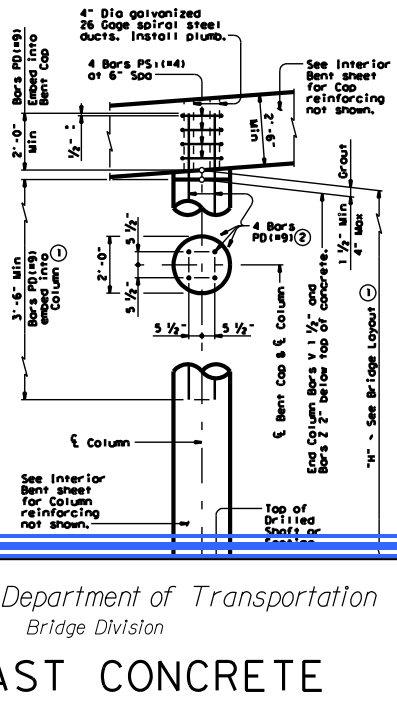

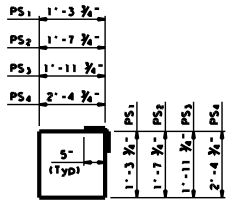

BARS PS (#4)

① Bars PD may need to be embedded in footing or drilled shaft for short columns.

② Location tolerance of dowels in columns/drilled shafts is ¼" from plan location, transversely and longitudinally.

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Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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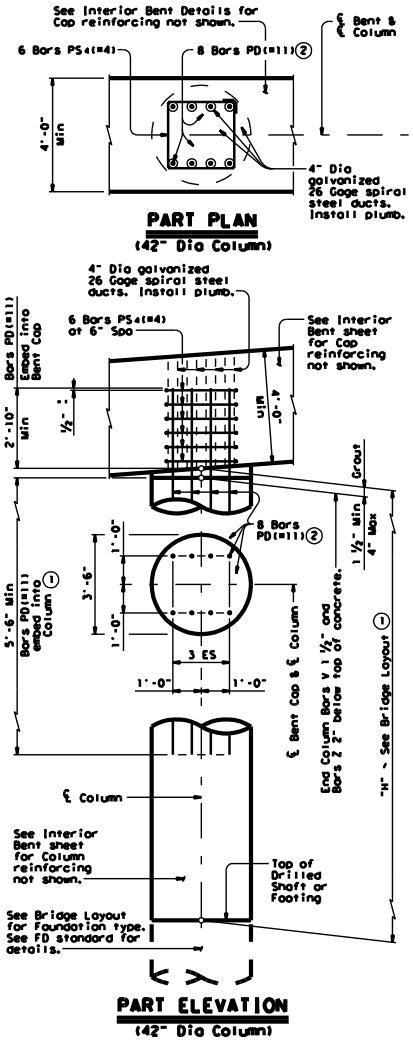

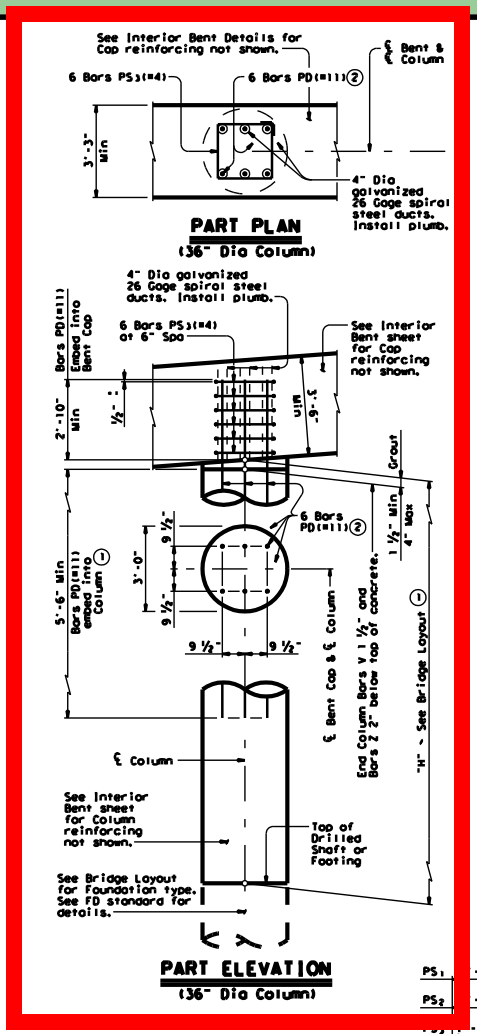

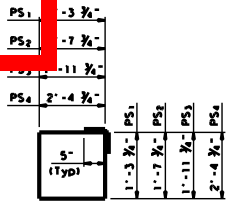

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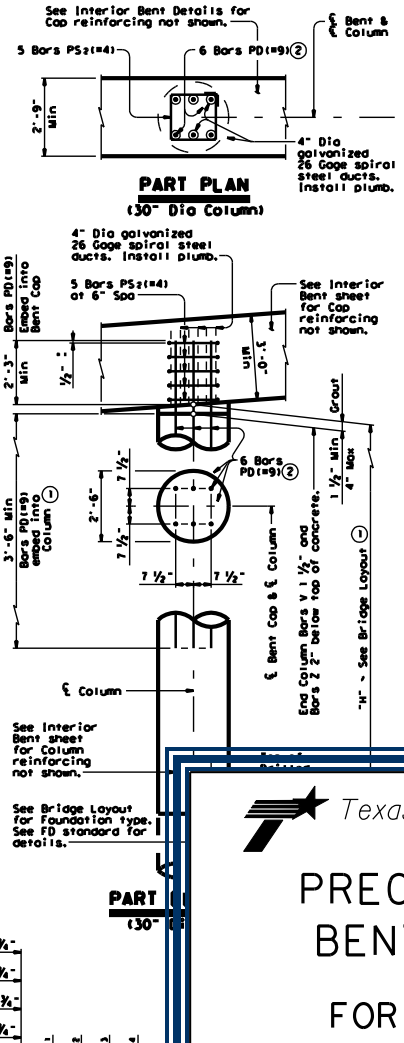

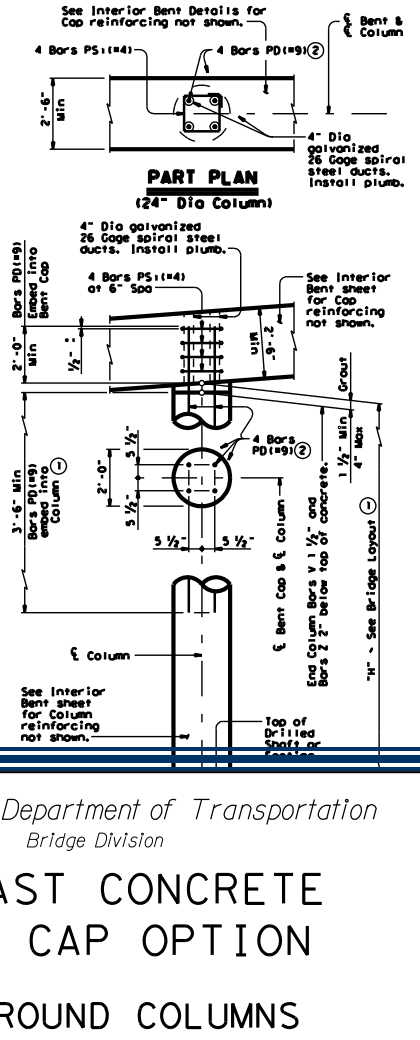

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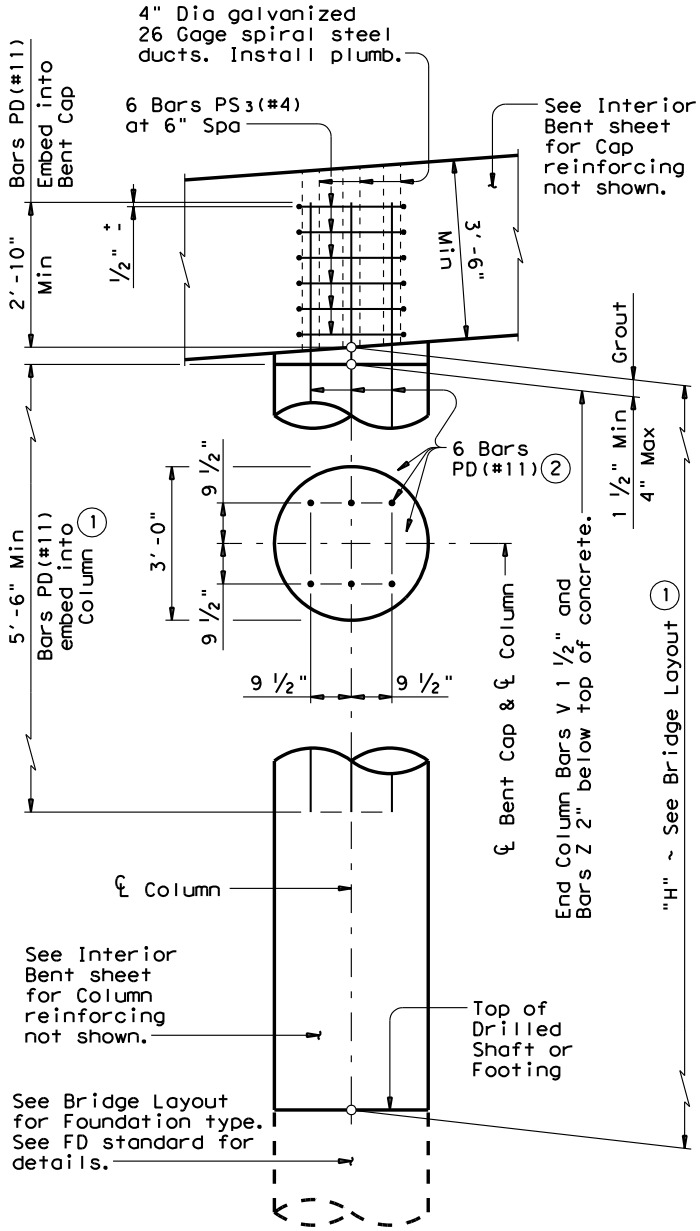

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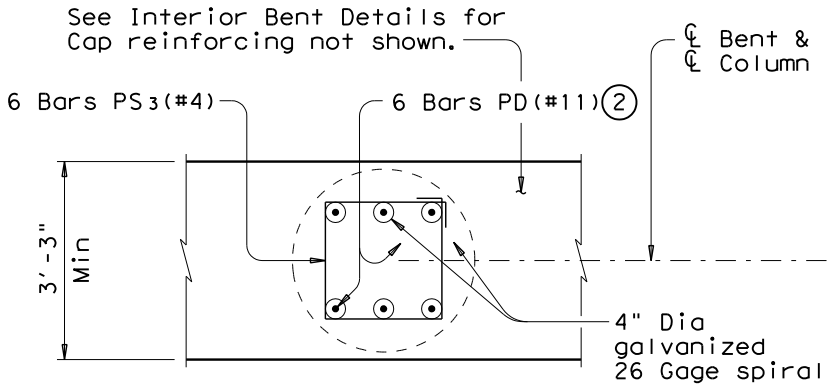

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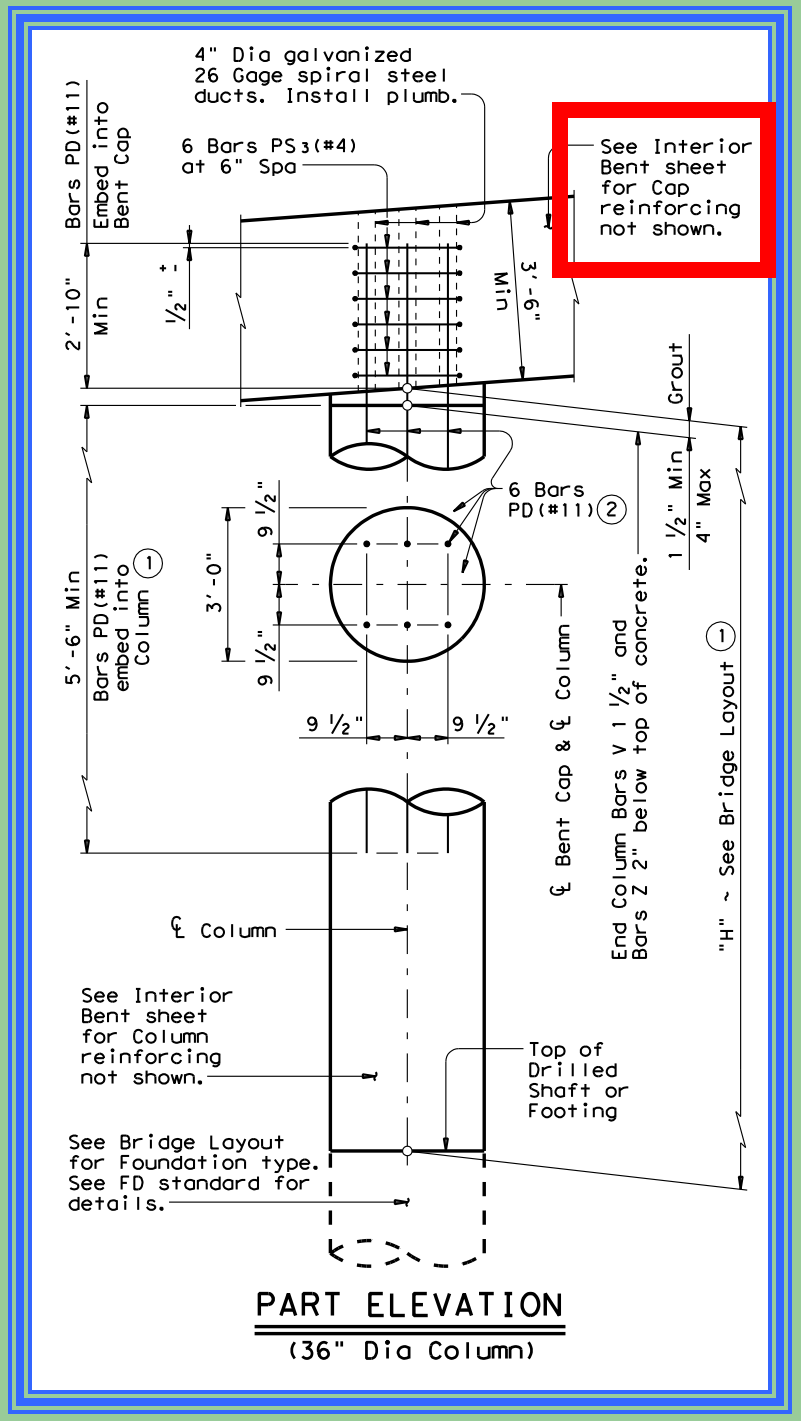

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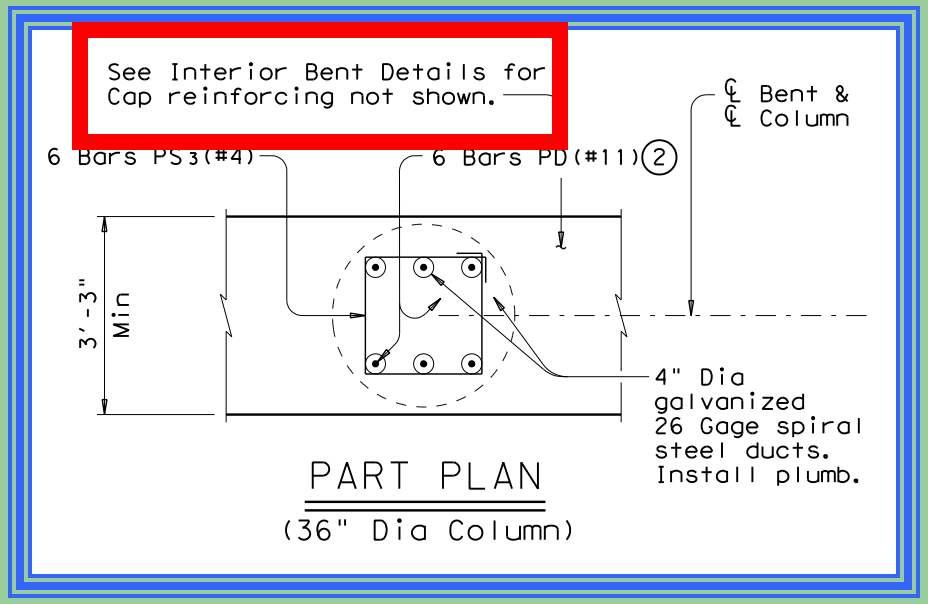

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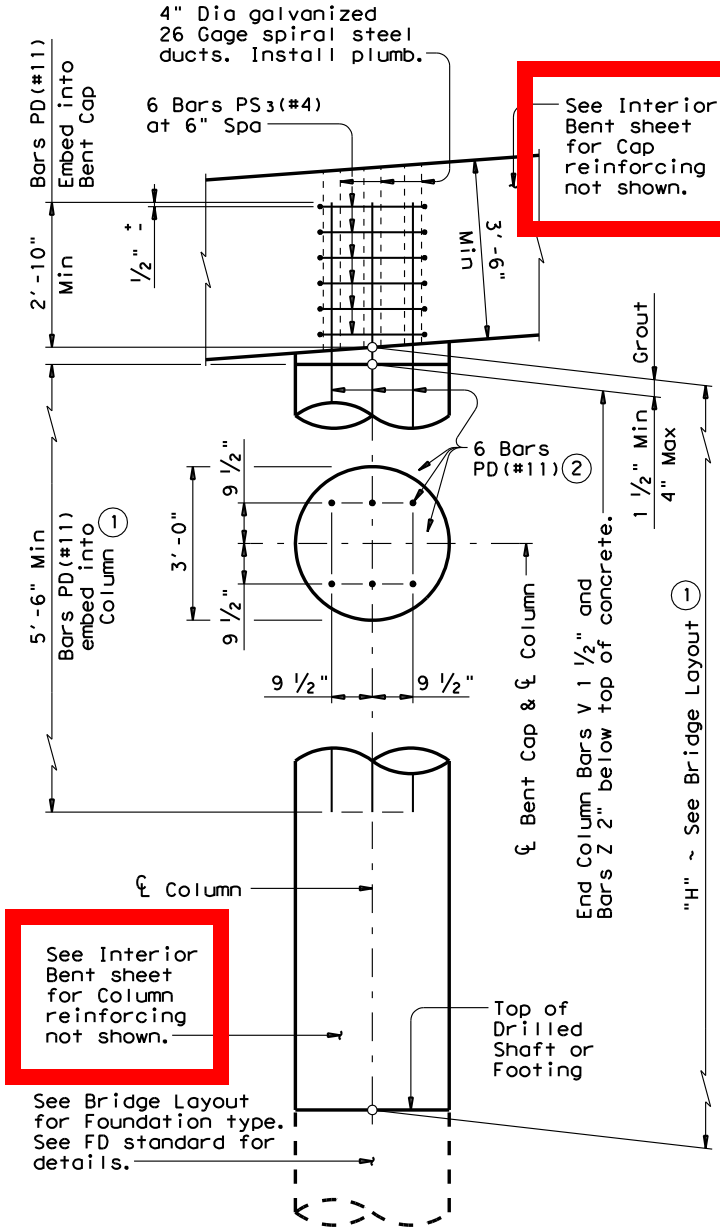

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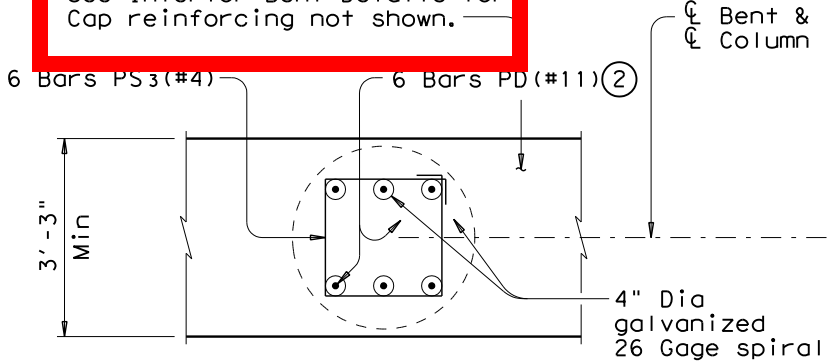
(36" Dia Column)

See Interior Bent Details for Cap reinforcing not shown.



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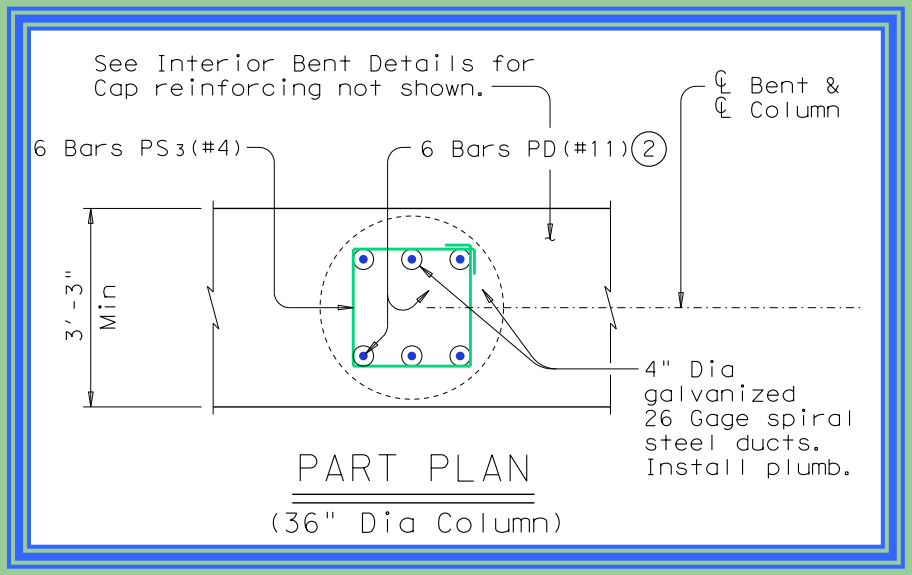

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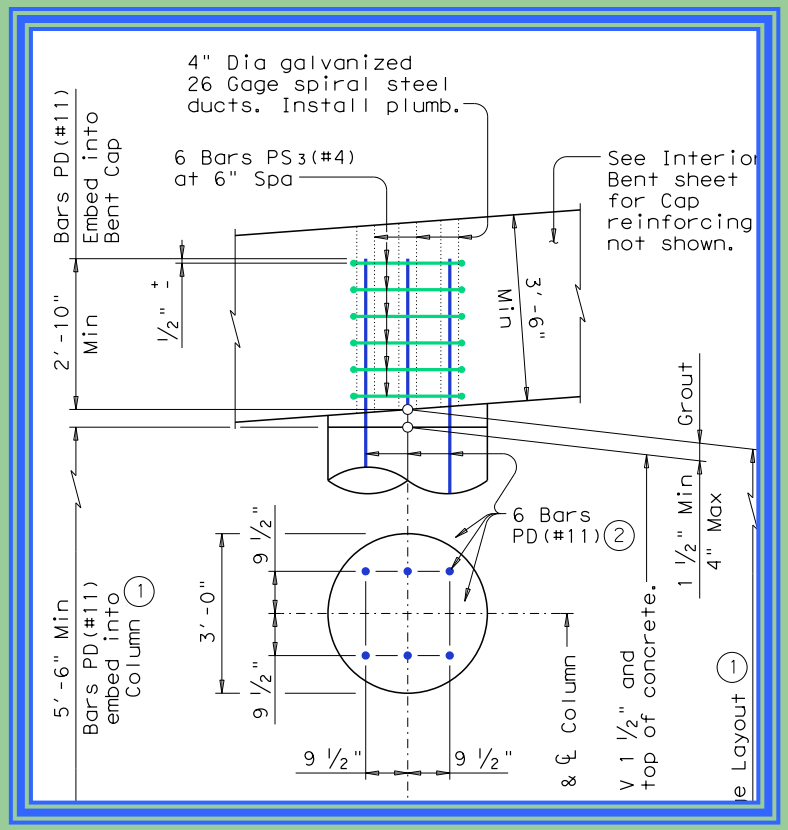

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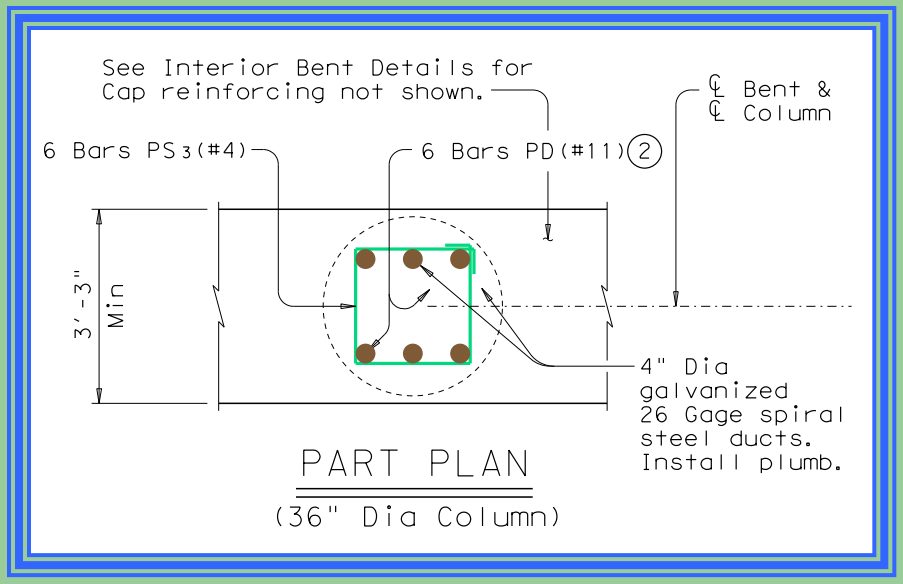

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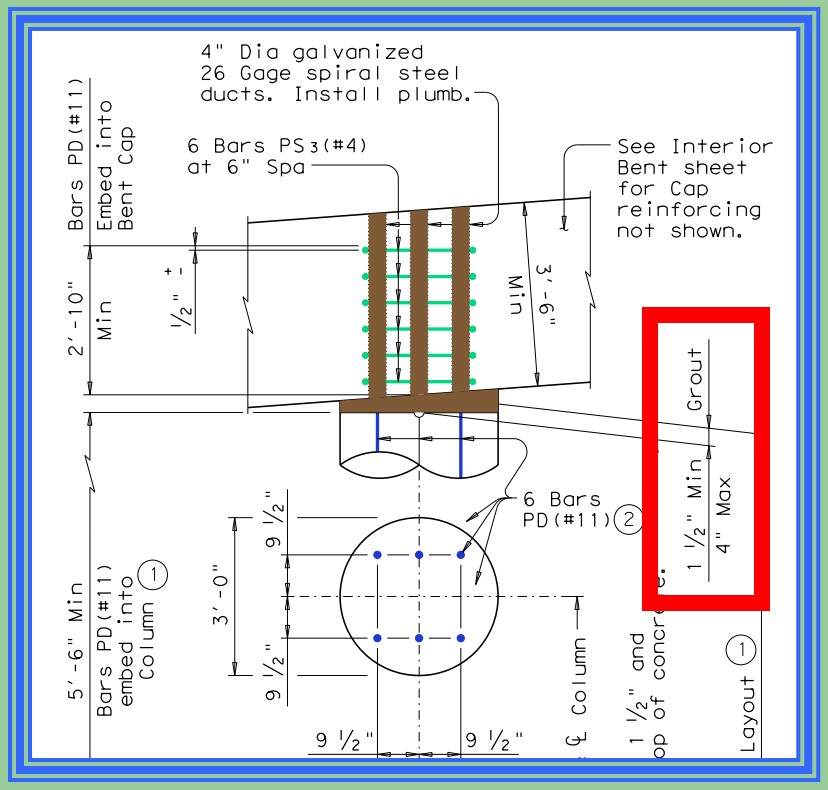

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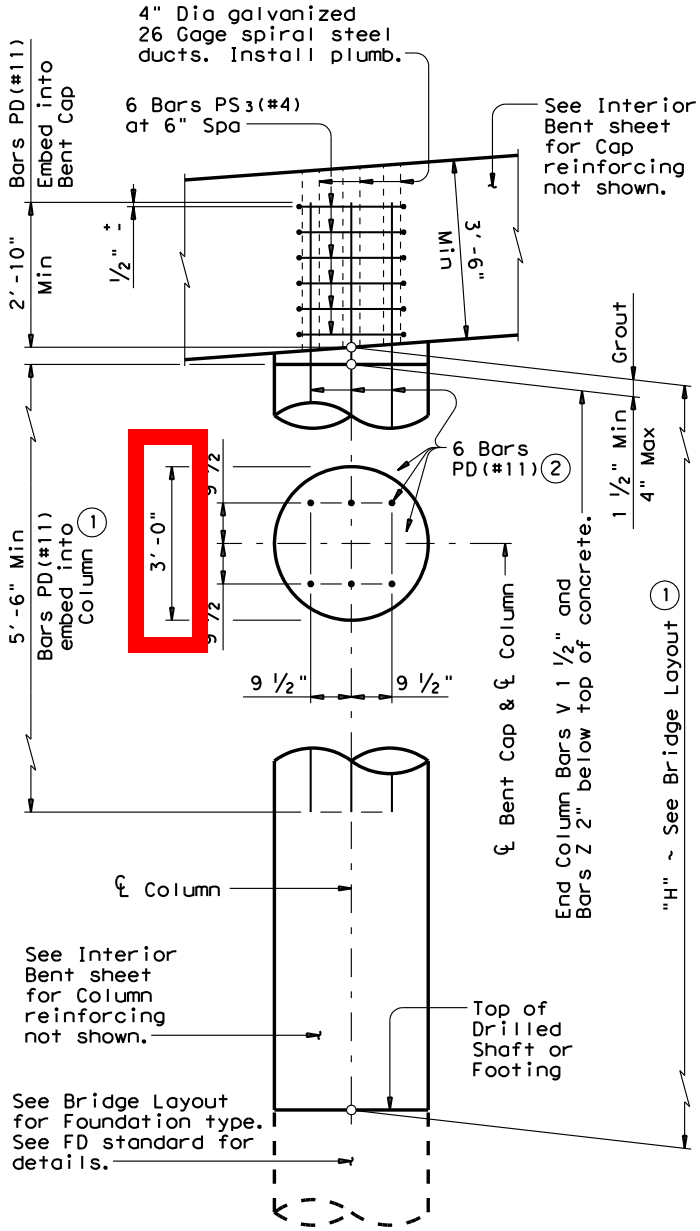

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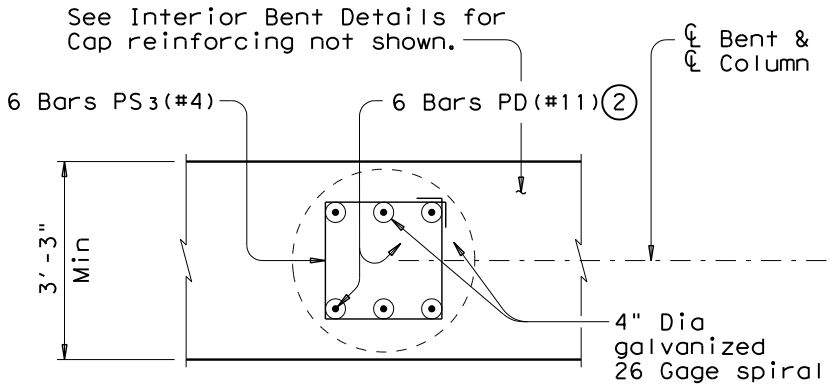

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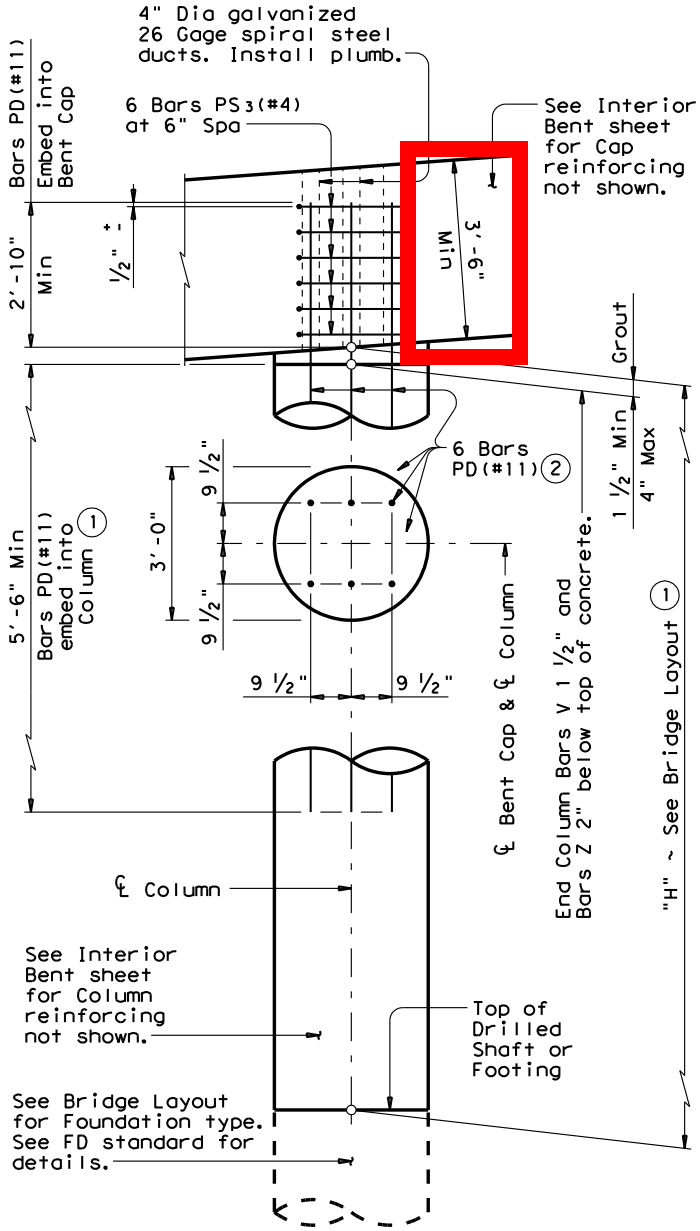

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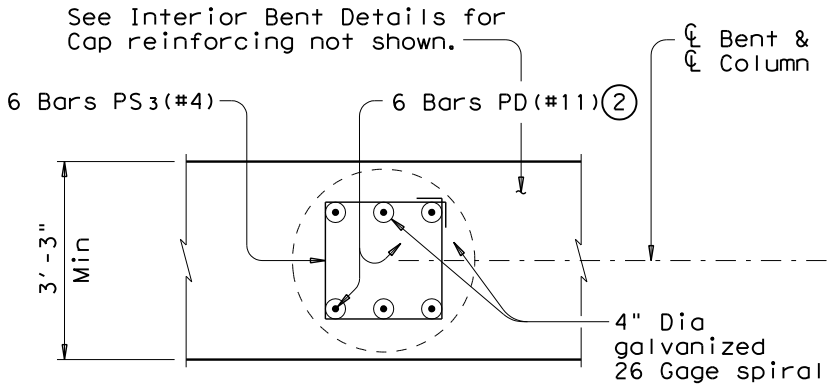

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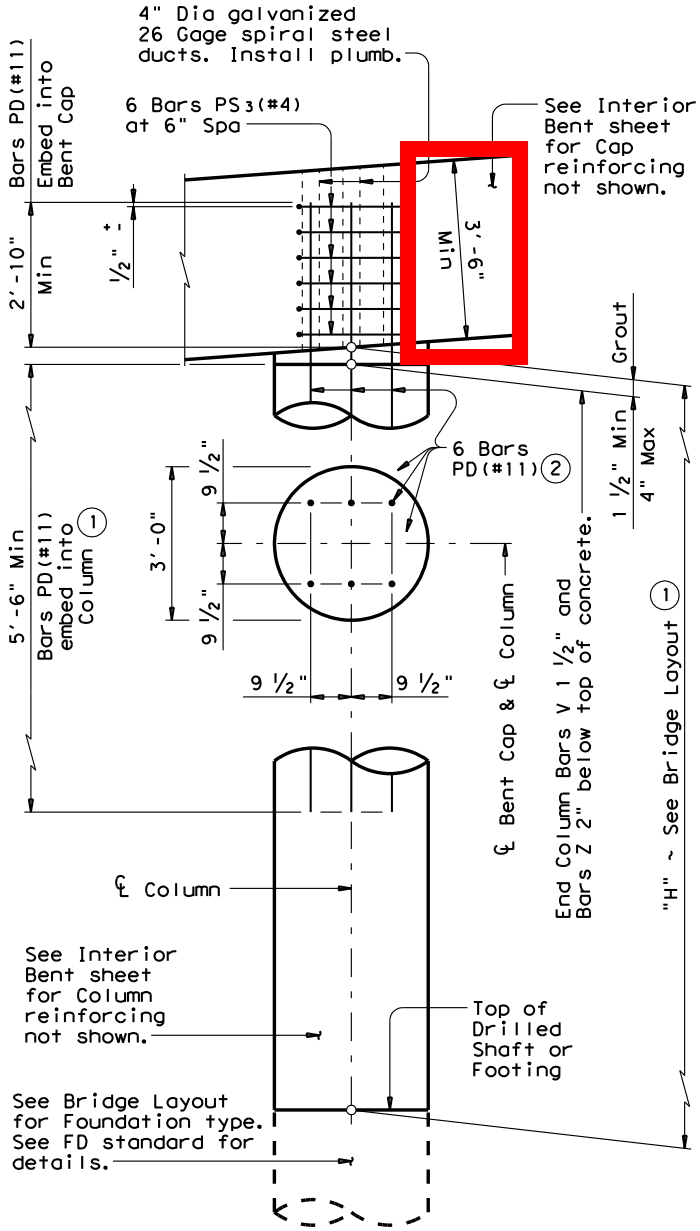

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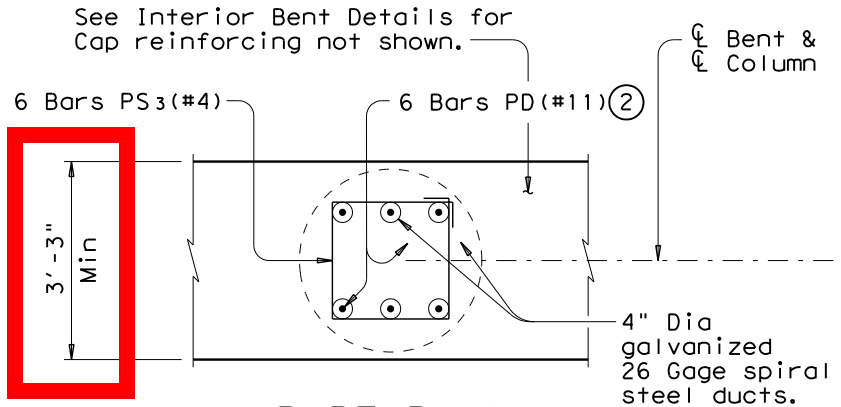

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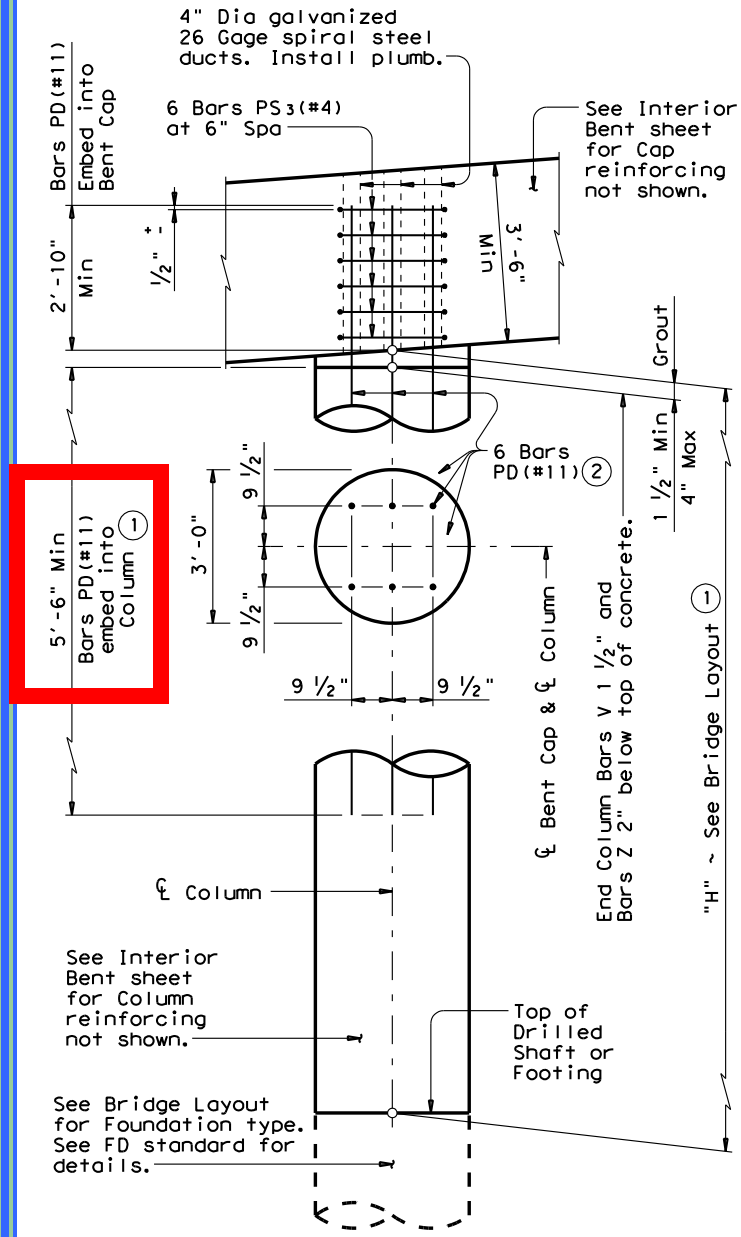

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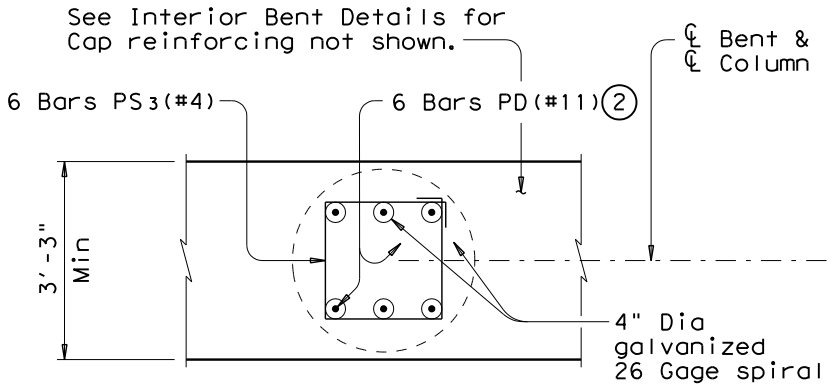

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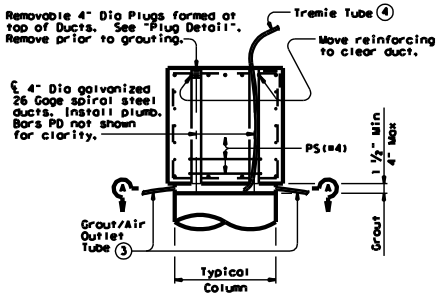
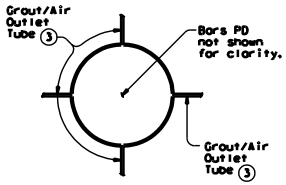
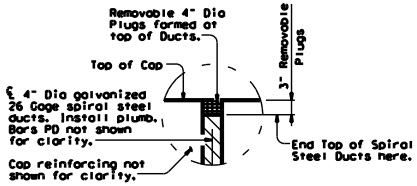


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



SECTION A-A



PLUG DETAIL

(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
Compatibility		
Expansion Requirements	Expansion per ASTM C1107	ASTM C1090 (Certified by Manufacturer)
Modulus of Elasticity	2,800 ksi to 5,000 ksi	ASTM C469 (Certified by Manufacturer)
Coefficient of Thermal Expansion	3.0×10^{-6} per deg F to 10.0×10^{-6} per deg F	ASTM C531 (Certified by Manufacturer)
Constructability		
Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions
Set Time Initial Final	2.5 to 5.0 hrs 4.0 to 8.0 hrs	ASTM C191 (Certified by Manufacturer)
Durability		
Freeze Thaw	300 cycles, RDF 90%	ASTM C666 (Certified by Manufacturer)

(3) Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.

(4) Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdrawn as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.

(5) Unless otherwise shown.

CONSTRUCTION NOTES:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Caps may be placed on columns/drilled shafts after column/drilled shaft concrete has achieved a flexural strength of 355 psi for 2,500 psi compressive strength). Use plastic shims or friction collars to support the cap at the proper elevation prior to grouting. Total area of plastic shims used on top of each column may not exceed 6 percent of the column area. Column/drilled shaft curing may be interrupted a maximum of 2 hours for placement of plastic shims or friction collars and cap placement.

Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. When lifting loops are removed, remove them to a point 1" below cap surface and patch with an approved material.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

MATERIAL NOTES:

Use prepackaged, cementitious, non-shrink grout conforming to ASTM C 1107. Allowed grouts include BASF Masterflow 928, SikaGrout 212, and Euclid Hi-Flow, although grout selected must further meet the additional performance requirements listed in the Table of Grout Specifications and any other requirement as listed elsewhere. In case of conflict between ASTM C 1107 and the listed requirements, the listed requirements govern. Do not use grouts using metallic formulations or with chorides. No additives to the grout are permitted.

Use semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

All reinforcing must be Grade 60. Epoxy coat all reinforcement if column reinforcement is epoxy coated.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

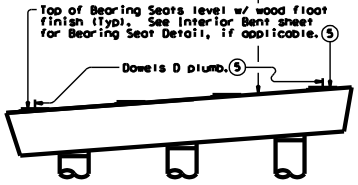
The Contractor has the option to provide precast bent caps in accordance with the details shown. No additional payment will be made if the Contractor uses precast caps. Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Construct and cure cap in accordance with Item 420, "Concrete Structures". Secure ducts to prevent their movement during concrete placement. Location tolerance of ducts is ¼" from plan location, transversely and longitudinally. Seal ducts to prevent intrusion of concrete.

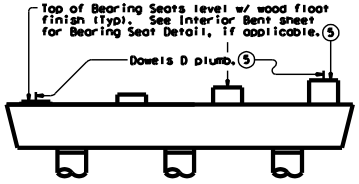
Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.H. Do not locate lift points at bearing seats if bearing seats are precast.

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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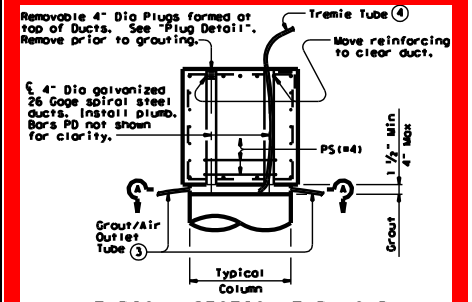
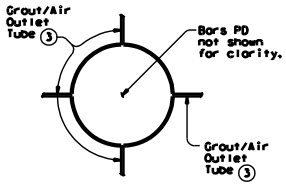
	COUNTY	CONTROL	SECT	JOB	HIGHWAY

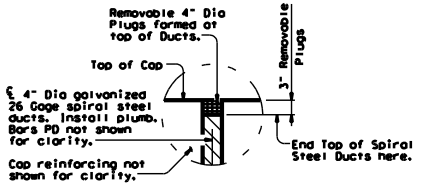


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



SECTION A-A



PLUG DETAIL

(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
Compatibility		
Expansion Requirements	Expansion per ASTM C1107	ASTM C1090 (Certified by Manufacturer)
Modulus of Elasticity	2,800 ksi to 5,000 ksi	ASTM C469 (Certified by Manufacturer)
Coefficient of Thermal Expansion	3.0×10^{-6} per deg F to 10.0×10^{-6} per deg F	ASTM C531 (Certified by Manufacturer)
Constructability		
Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions
Set Time Initial Final	2.5 to 5.0 hrs 4.0 to 8.0 hrs	ASTM C191 (Certified by Manufacturer)
Durability		
Freeze Thaw	300 cycles, RDF 90%	ASTM C666 (Certified by Manufacturer)

(3) Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.

(4) Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdrawn as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.

(5) Unless otherwise shown.

CONSTRUCTION NOTES:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

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Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. When lifting loops are removed, remove them to a point 1" below cap surface and patch with an approved material.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

MATERIAL NOTES:

Use prepackaged, cementitious, non-shrink grout conforming to ASTM C 1107. Allowed grouts include BASF Masterflow 928, SikaGrout 212, and Euclid Hi-Flow, although grout selected must further meet the additional performance requirements listed in the Table of Grout Specifications and any other requirement as listed elsewhere. In case of conflict between ASTM C 1107 and the listed requirements, the listed requirements govern. Do not use grouts using metallic formulations or with chorides. No additives to the grout are permitted.

Use semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

All reinforcing must be Grade 60. Epoxy coat all reinforcement if column reinforcement is epoxy coated.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

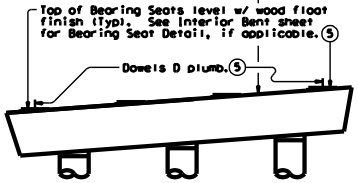
The Contractor has the option to provide precast bent caps in accordance with the details shown. No additional payment will be made if the Contractor uses precast caps. Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Construct and cure cap in accordance with Item 420, "Concrete Structures". Secure ducts to prevent their movement during concrete placement. Location tolerance of ducts is ¼" from plan location, transversely and longitudinally. Seal ducts to prevent intrusion of concrete.

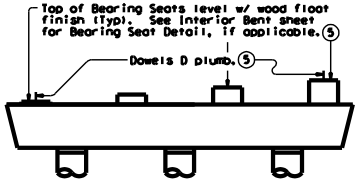
Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.H. Do not locate ties points at bearing seats if bearing seats are precast.

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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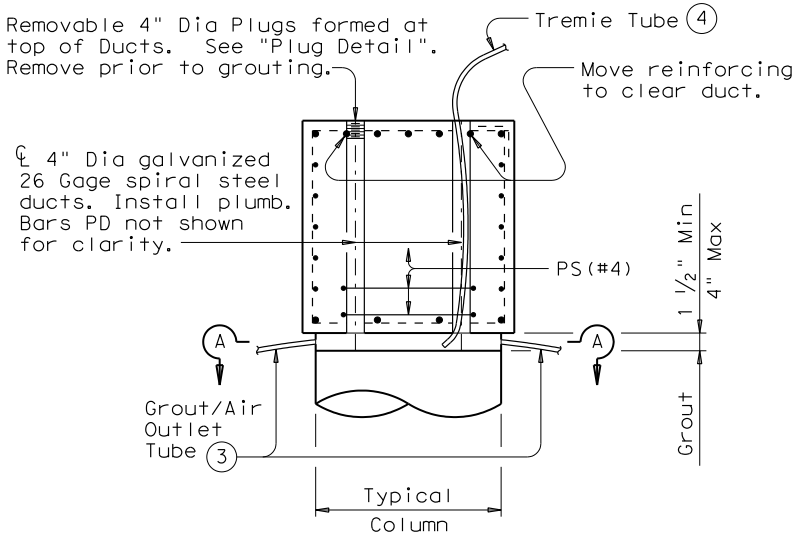
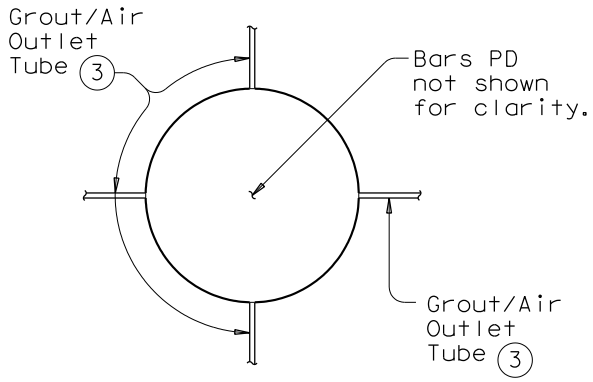
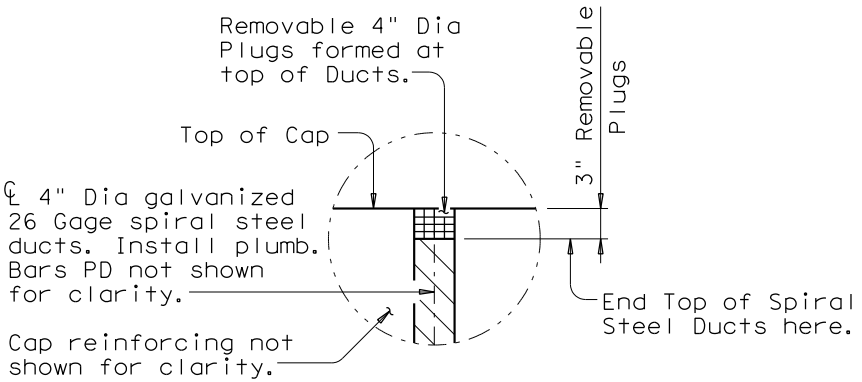


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



SECTION A-A



PLUG DETAIL

(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

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REVISIONS					
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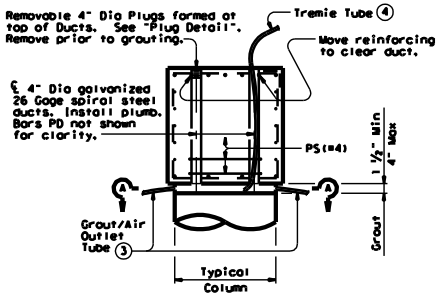
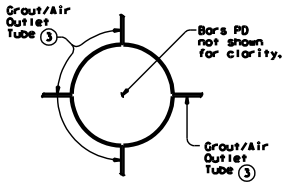
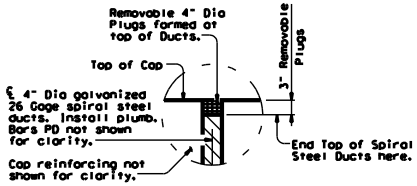


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



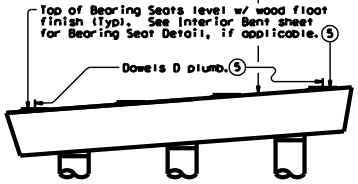
SECTION A-A



PLUG DETAIL

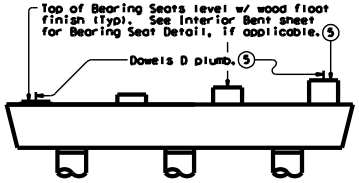
placement. Remove prior to grouting)

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
Compatibility		
Expansion Requirements	Expansion per ASTM C1107	ASTM C1090 (Certified by Manufacturer)
Modulus of Elasticity	2,800 ksi to 5,000 ksi	ASTM C469 (Certified by Manufacturer)
Coefficient of Thermal Expansion	3.0×10^{-6} per deg F to 10.0×10^{-6} per deg F	ASTM C531 (Certified by Manufacturer)
Constructability		
Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions
Set Time Initial Final	 2.5 to 5.0 hrs 4.0 to 8.0 hrs	 ASTM C191 (Certified by Manufacturer)
Durability		
Freeze Thaw	300 cycles, RDF 90%	ASTM C666 (Certified by Manufacturer)

(3) Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.

(4) Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdrawn as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.

(5) Unless otherwise shown.

CONSTRUCTION NOTES:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

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Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. When lifting loops are removed, remove them to a point 1" below cap surface and patch with an approved material.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

MATERIAL NOTES:

Use prepackaged, cementitious, non-shrink grout conforming to ASTM C 1107. Allowed grouts include BASF Masterflow 928, SikaGrout 212, and Euclid Hi-Flow, although grout selected must further meet the additional performance requirements listed in the Table of Grout Specifications and any other requirement as listed elsewhere. In case of conflict between ASTM C 1107 and the listed requirements, the listed requirements govern. Do not use grouts using metallic formulations or with chorides. No additives to the grout are permitted.

Use semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

All reinforcing must be Grade 60. Epoxy coat all reinforcement if column reinforcement is epoxy coated.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

The Contractor has the option to provide precast bent caps in accordance with the details shown. No additional payment will be made if the Contractor uses precast caps. Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

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Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.4. Do not locate field splices at bearing seats if bearing seats are precast.

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

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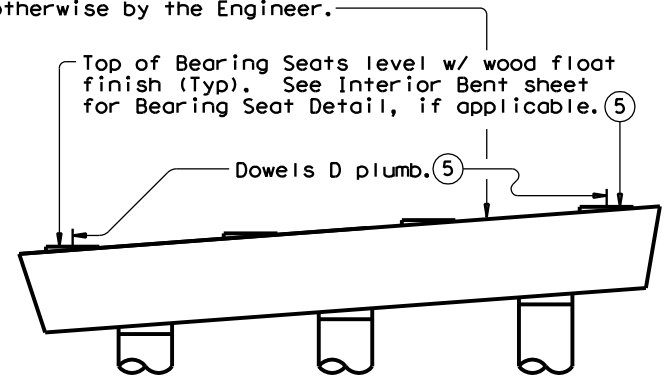
Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

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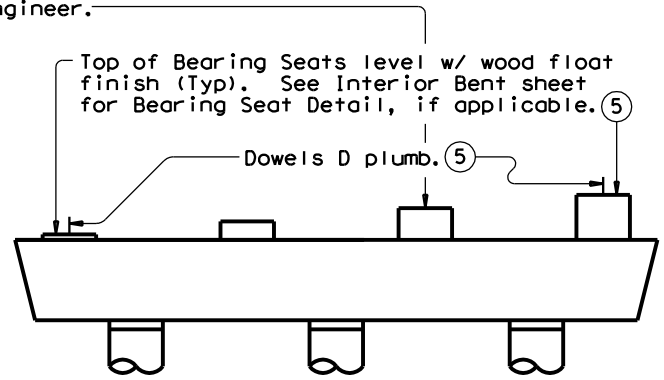

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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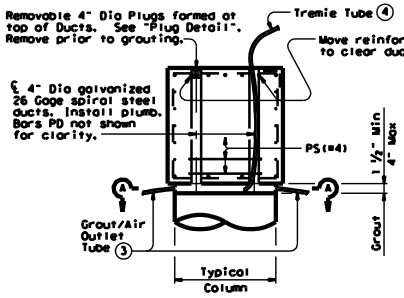
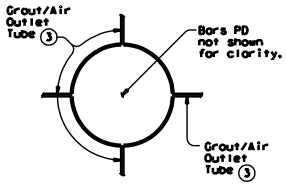
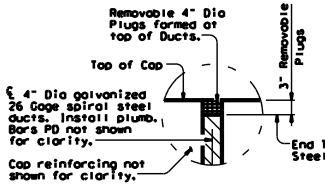


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



SECTION A-A



PLUG DETAIL

(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
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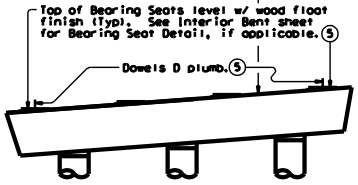
Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Construct and cure cap in accordance with Item 420, "Concrete Structures". Secure ducts to prevent their movement during concrete placement. Location tolerance of ducts is ¼" from plan location, transversely and longitudinally. Seal ducts to prevent intrusion of concrete.

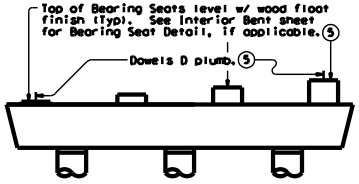
Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.H. Do not locate tie rods at bearing seats if bearing seats are precast.

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
Compatibility		
Expansion Requirements	Expansion per ASTM C1107	ASTM C1090 (Certified by Manufacturer)
Modulus of Elasticity	2,800 ksi to 5,000 ksi	ASTM C469 (Certified by Manufacturer)
Coefficient of Thermal Expansion	3.0×10^{-6} per deg F to 10.0×10^{-6} per deg F	ASTM C531 (Certified by Manufacturer)
Constructability		
Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions
Set Time Initial Final	 2.5 to 5.0 hrs 4.0 to 8.0 hrs	 ASTM C191 (Certified by Manufacturer)
Durability		
Freeze Thaw	300 cycles, RDF 90%	ASTM C666 (Certified by Manufacturer)

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

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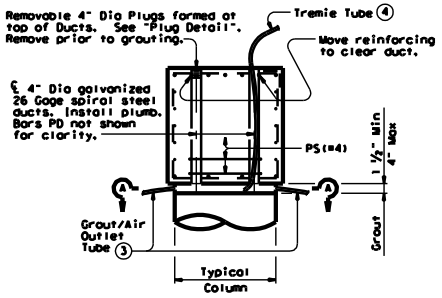
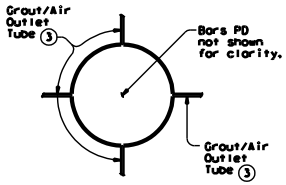
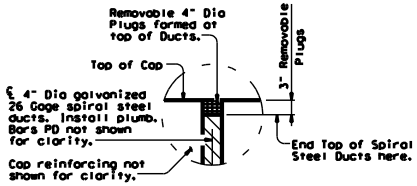


TYPICAL SECTION THRU CAP

(Showing Example of Ducts and Cap Reinforcing)



SECTION A-A



PLUG DETAIL

(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

TABLE OF GROUT SPECIFICATIONS

PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
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Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions
Set Time Initial Final	2.5 to 5.0 hrs 4.0 to 8.0 hrs	ASTM C191 (Certified by Manufacturer)
Durability		
Freeze Thaw	300 cycles, RDF 90%	ASTM C666 (Certified by Manufacturer)

(3) Provide at least 4 grout/air outlet tubes equally spaced around the perimeter of the column. Install at bottom of cap to avoid air entrapment. Seal off tubes sequentially when a steady flow of grout without air occurs. Secondary tubes to help drain water, located at top of column, may also be installed.

(4) Continuous gravity-flow grouting through a tremie tube is recommended. With this method, lower a flexible tremie tube through one of the vertical ducts to the bottom of the bedding layer and fill the connection from the bottom upward with a continuous flow of grout. This method requires a sufficient amount of grout to be mixed prior to grouting and that the funnel connected to the tremie tube have adequate volume capacity (4 quarts Min is recommended). A valve may be used to stop the flow during grouting to allow refilling the funnel or to tamp the grout. The tube should remain within the grout and gradually withdrawn as the level of the grout rises in the ducts. It is critical to ensure a continuous flow of grout to avoid air entrapment. Alternative methods, including pressure grouting with low pressure pumps, may be used provided they are proved effective in providing void-free connections during the mock-up phase.

(5) Unless otherwise shown.

CONSTRUCTION NOTES:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Caps may be placed on columns/drilled shafts after column/drilled shaft concrete has achieved a flexural strength of 355 psi (or 2,500 psi compressive strength). Use plastic shims or friction collars to support the cap at the proper elevation prior to grouting. Total area of plastic shims used on top of each column may not exceed 6 percent of the column area. Column/drilled shaft curing may be interrupted a maximum of 2 hours for placement of plastic shims or friction collars and cap placement.

Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. When lifting loops are removed, remove them to a point 1" below cap surface and patch with an approved material.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2,500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

MATERIAL NOTES:

Use prepackaged, cementitious, non-shrink grout conforming to ASTM C 1107. Allowed grouts include BASF Masterflow 928, SikaGrout 212, and Euclid Hi-Flow, although grout selected must further meet the additional performance requirements listed in the Table of Grout Specifications and any other requirement as listed elsewhere. In case of conflict between ASTM C 1107 and the listed requirements, the listed requirements govern. Do not use grouts using metallic formulations or with chorides. No additives to the grout are permitted.

Use semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

All reinforcing must be Grade 60. Epoxy coat all reinforcement if column reinforcement is epoxy coated.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

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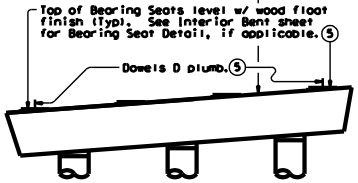

CAP SET AT SLOPE

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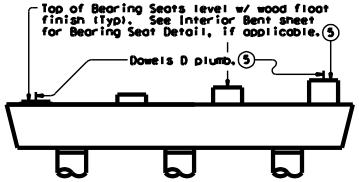

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION

FOR ROUND COLUMNS

PBC-RC

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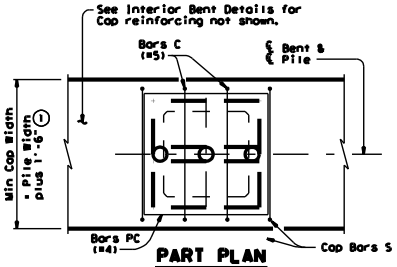
Notes: (Construction/Material/General)

- Grout mock up (one week)
- Cap lifting ~ Cap concrete min 2,500 psi
- Cap placement ~ Column concrete min 2,500 psi
- Friction collar removal and beam placement ~ Grout min 2,500 psi
- Other loadings ~ Grout @ 28 day strength
- Plastic shims or friction collars (NO steel shims)
- All grouted connections must be free of voids

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - **Piles (Concrete and H-Piles) (PBC-P)**
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - Do's and Don'ts
  - Location of Standard Drawings
- Questions



PART PLAN
CONCRETE PILE

① Provide wider cap if necessary. Adjust cap bars S dimensions accordingly. All quantity adjustments are at the Contractor's expense.

② 1'-0" (-2 ½", -0") with 16" and 18" piles; 1'-6" (-2 ½", -0") with 20" and 24" piles

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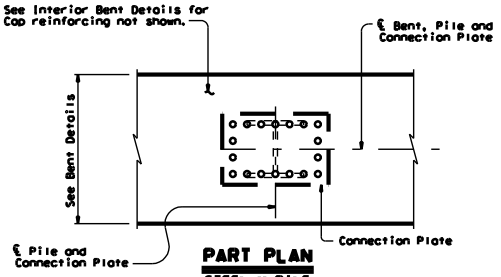
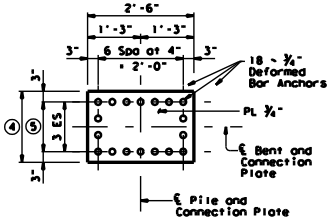
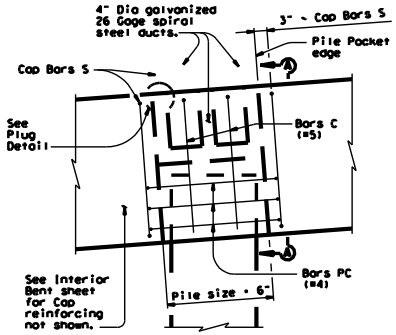


PART PLAN
STEEL H-PILE

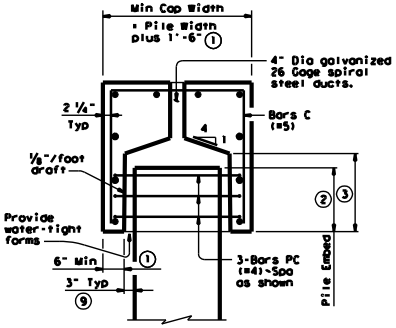


PLAN

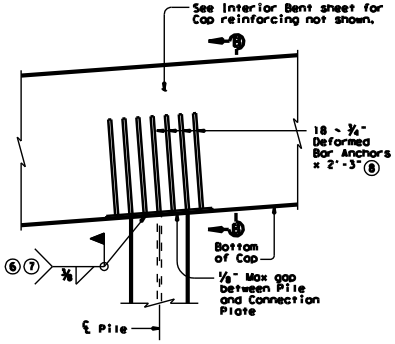
CONNECTION PLATE DETAIL
Electric arc and weld deformed bar anchors with complete fusion.



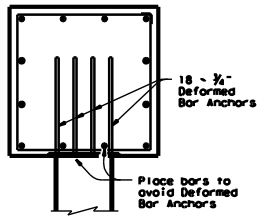
PART ELEVATION
CONCRETE PILE



SECTION A-A
Showing example Cap reinforcing



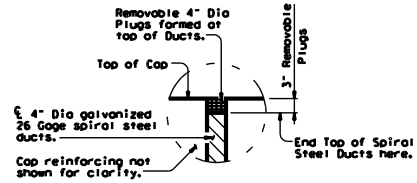
PART ELEVATION
STEEL H-PILE



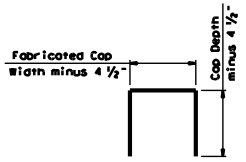
SECTION B-B
Showing example Cap reinforcing

④ Pile size plus 6"

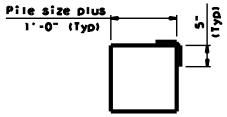
⑤ Pile size (Example: 1'-2" for HP14)



PLUG DETAIL
(To keep concrete out of ducts during concrete placement. Remove prior to grouting)



BARS C (#5)
2 Required per Pile Pocket



BARS PC (#4)
3 Required per Pile Pocket

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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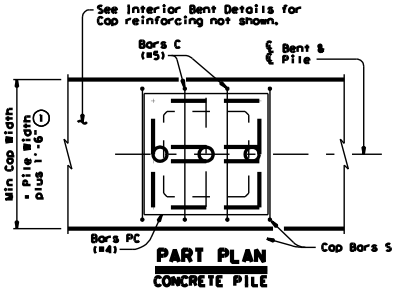
CONCRETE



PART PLAN
CONCRETE PILE

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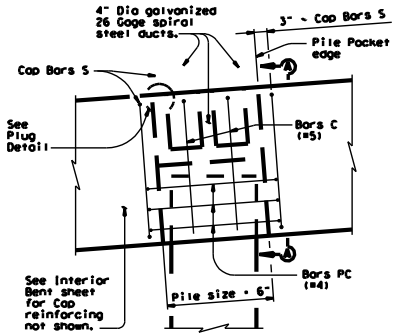
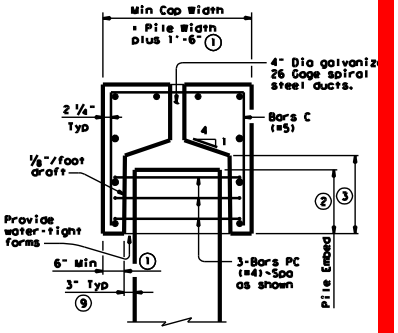
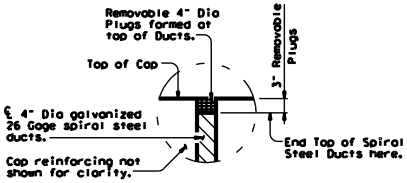


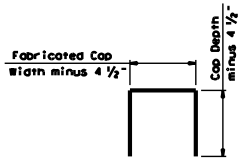
PART ELEVATION
CONCRETE PILE



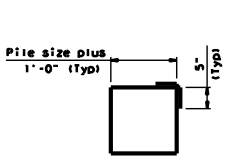
SECTION A-A
Showing example Cap reinforcing



PLUG DETAIL
(To keep concrete out of ducts during concrete placement. Remove prior to grouting)

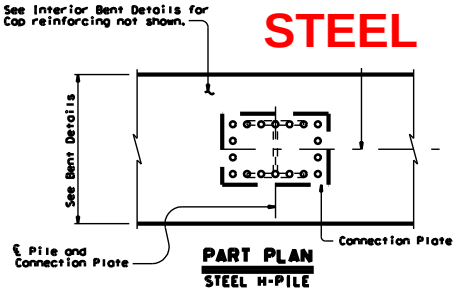


BARS C (#5)
2 Required per Pile Pocket

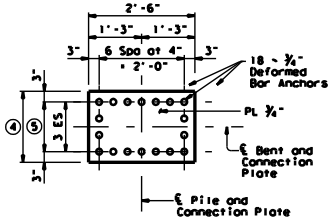


BARS PC (#4)
3 Required per Pile Pocket

STEEL

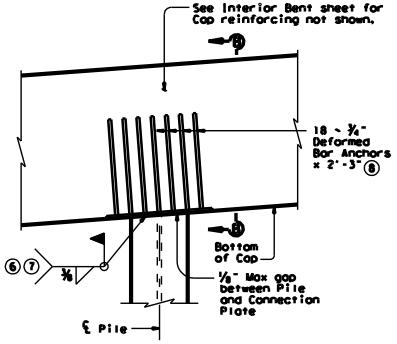


PART PLAN
STEEL H-PILE

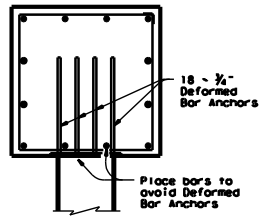


PLAN

CONNECTION PLATE DETAIL
Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION
STEEL H-PILE



SECTION B-B
Showing example Cap reinforcing

④ Pile size plus 6"
⑤ Pile size (Example: 1'-2" for HP14)
⑥ Increase weld size by amount of gap.
⑦ A certified welder is required.
⑧ If Cap height is less than 2'-9", Deformed Bar Anchor length is 8" less than Cap height.

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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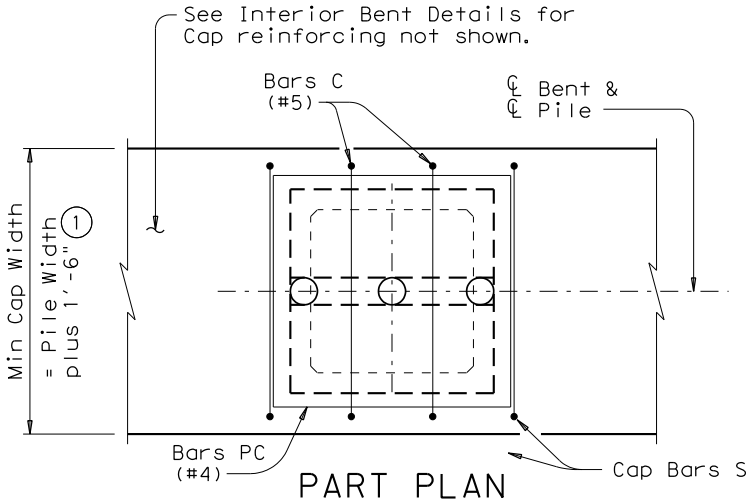
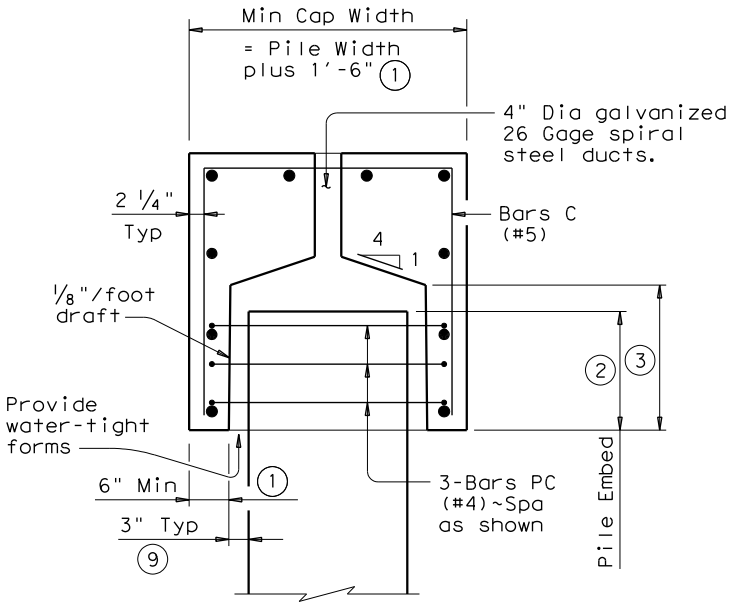


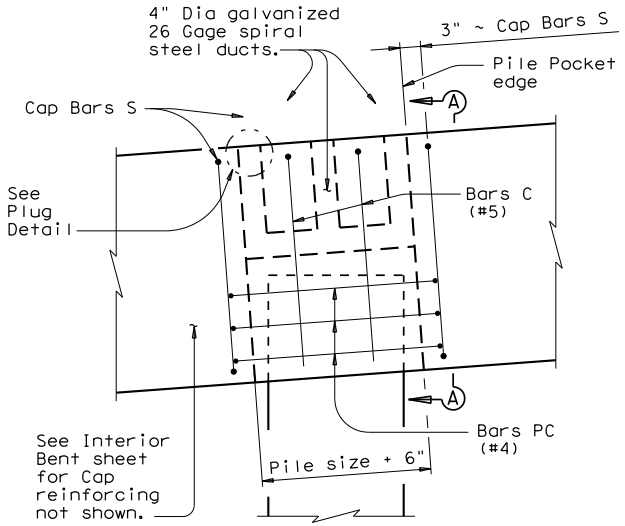
PART PLAN

CONCRETE PILE



SECTION A-A

Showing example Cap reinforcing



PART ELEVATION

CONCRETE PILE

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

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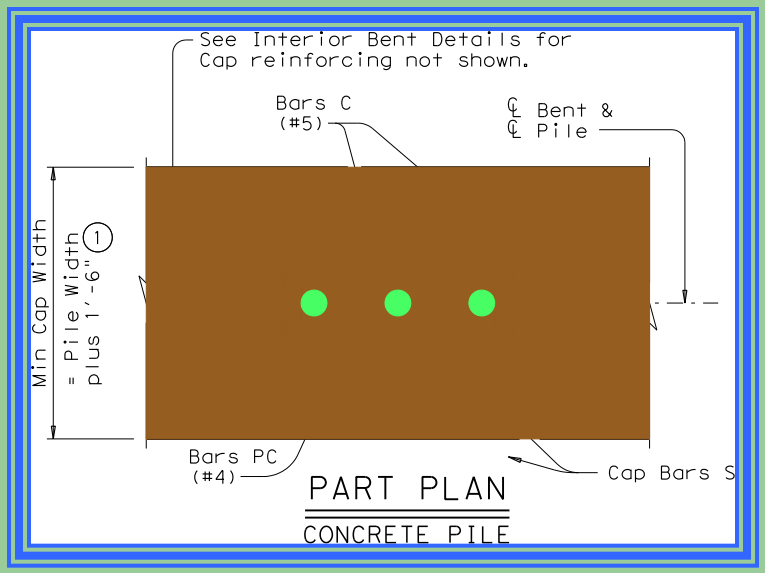
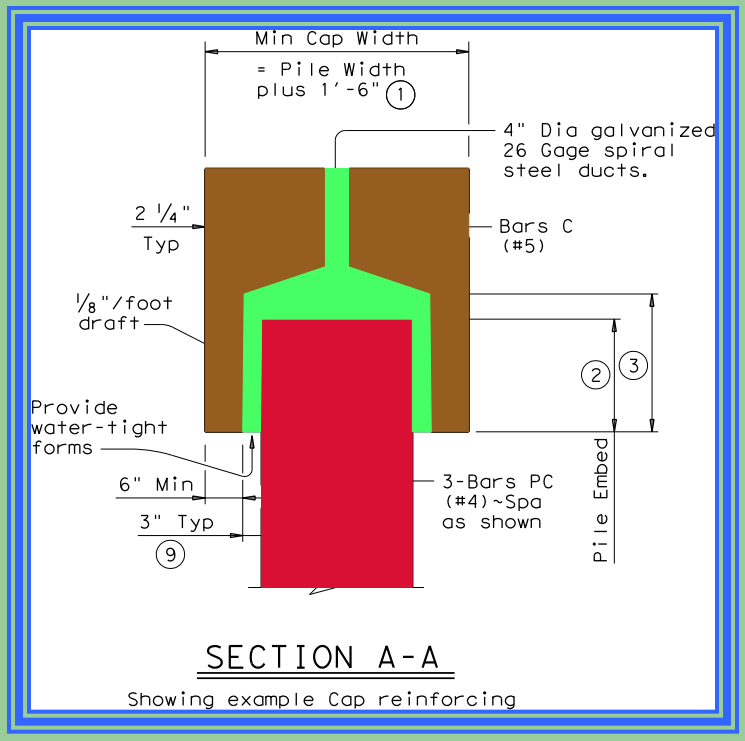


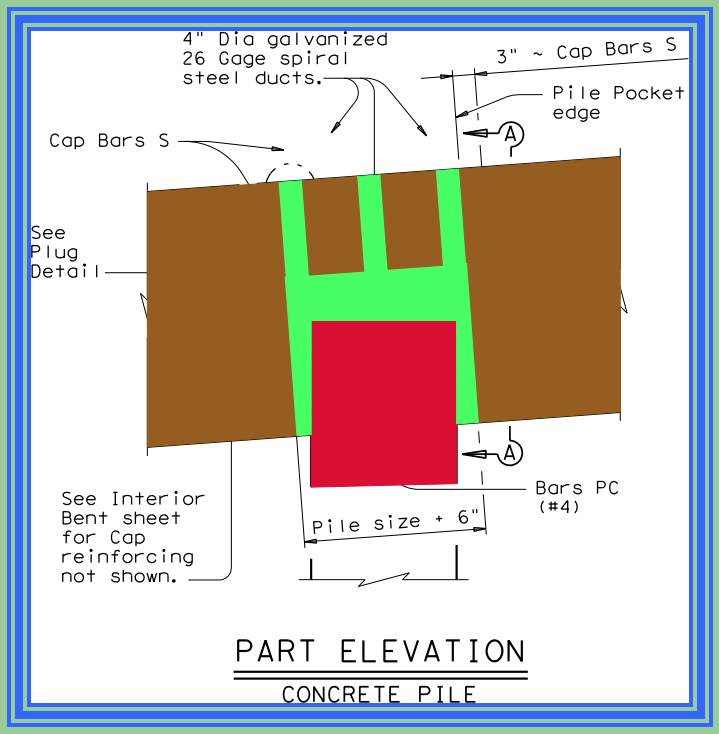
PART PLAN

CONCRETE PILE



SECTION A-A

Showing example Cap reinforcing



PART ELEVATION

CONCRETE PILE

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PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

PBC-P

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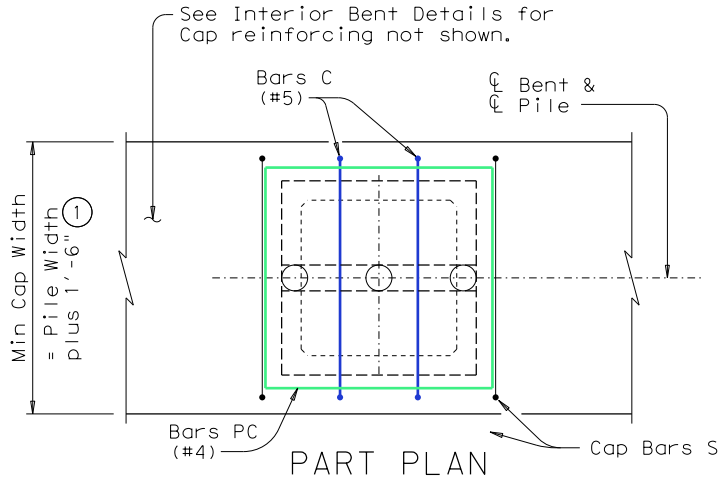
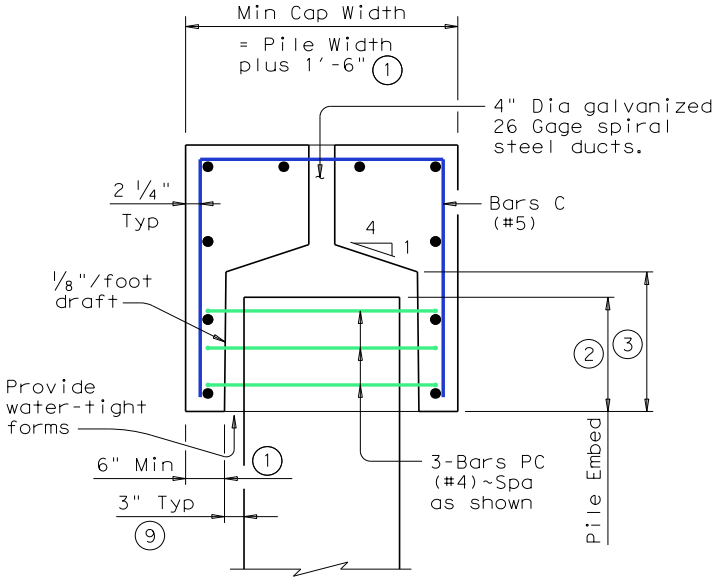
REVISIONS					
	COUNTY	CONTROL	SECT	JOB	HIGHWAY



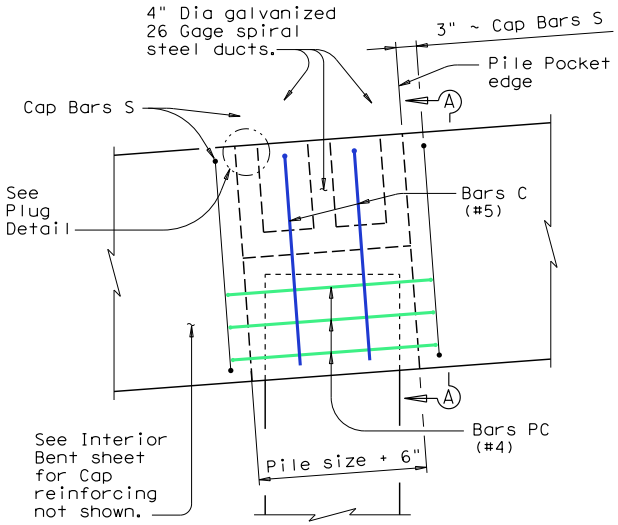
PART PLAN

CONCRETE PILE



SECTION A-A

Showing example Cap reinforcing



PART ELEVATION

CONCRETE PILE

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

PBC-P

FILE: pbcstd02.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
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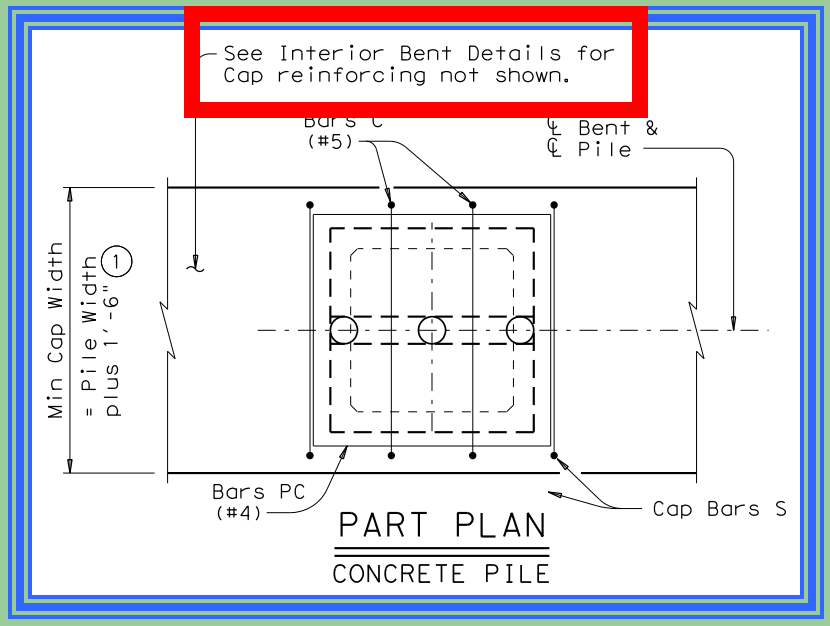
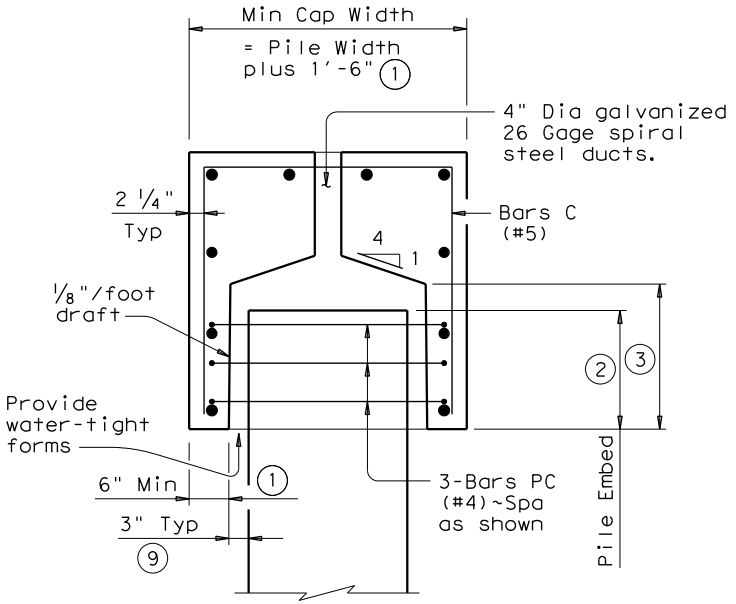


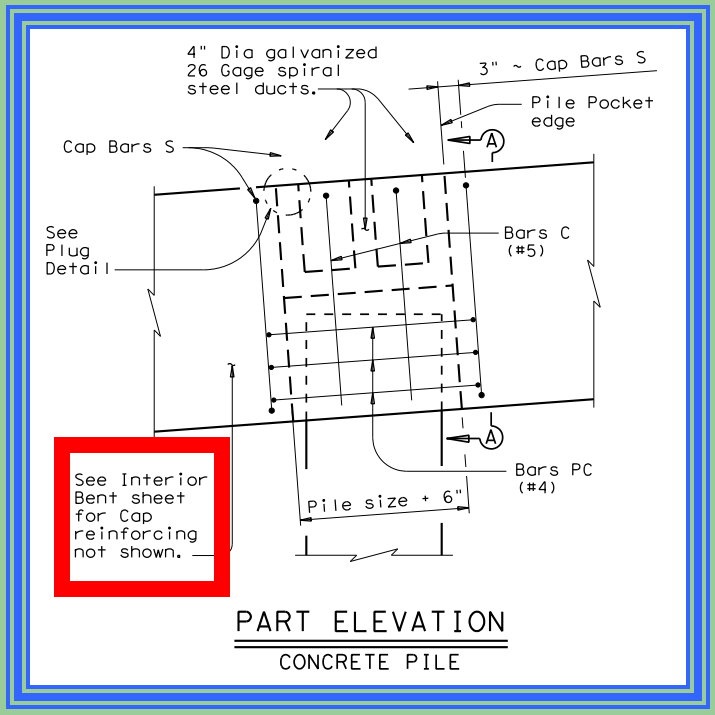
PART PLAN

CONCRETE PILE



SECTION A-A

Showing example Cap reinforcing



PART ELEVATION

CONCRETE PILE

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

PBC-P

FILE: pbcstd02.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT	
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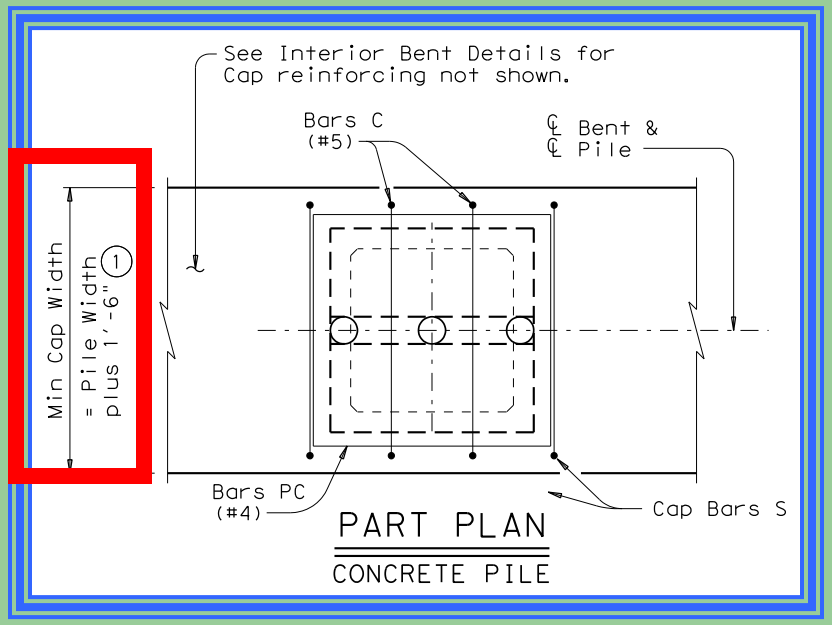
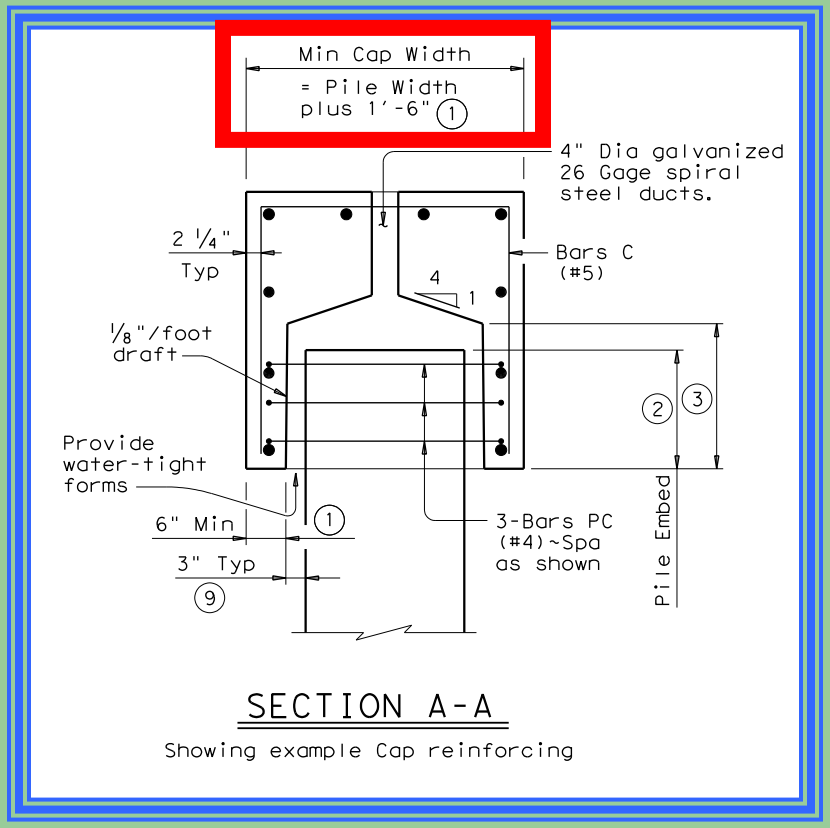


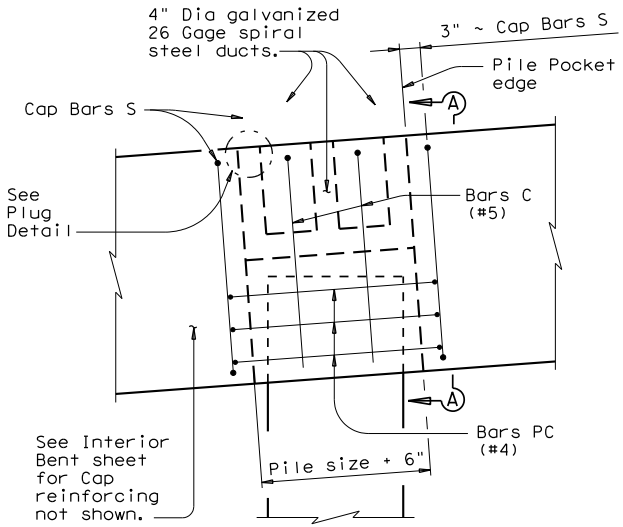
PART PLAN

CONCRETE PILE



SECTION A-A

Showing example Cap reinforcing



PART ELEVATION

CONCRETE PILE

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

PBC-P

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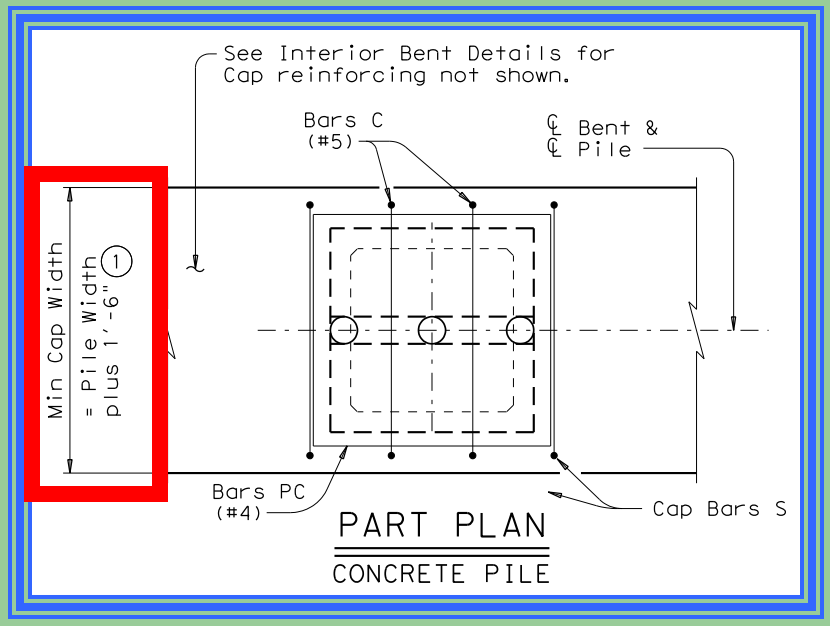
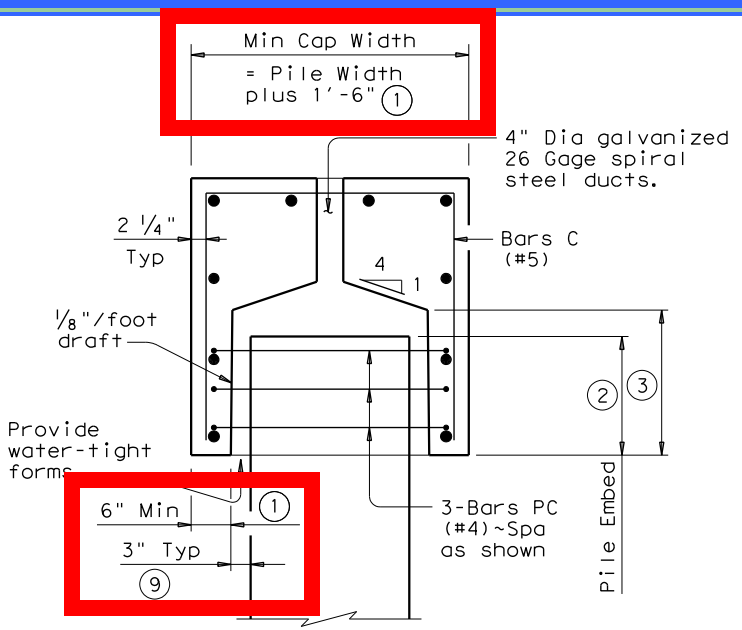
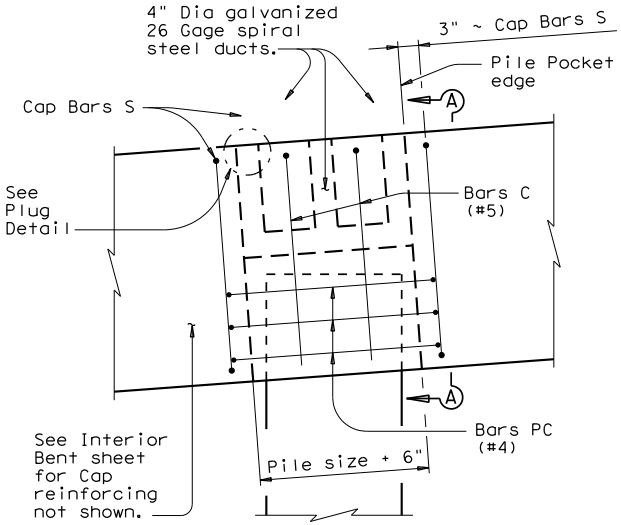


PART PLAN
CONCRETE PILE



SECTION A-A
Showing example Cap reinforcing



PART ELEVATION
CONCRETE PILE

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H PILES

PBC-P

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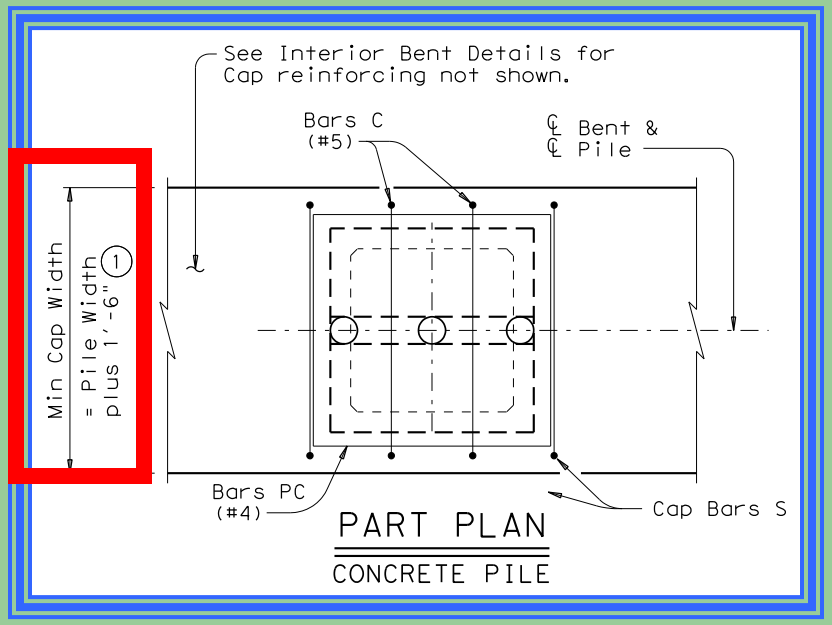
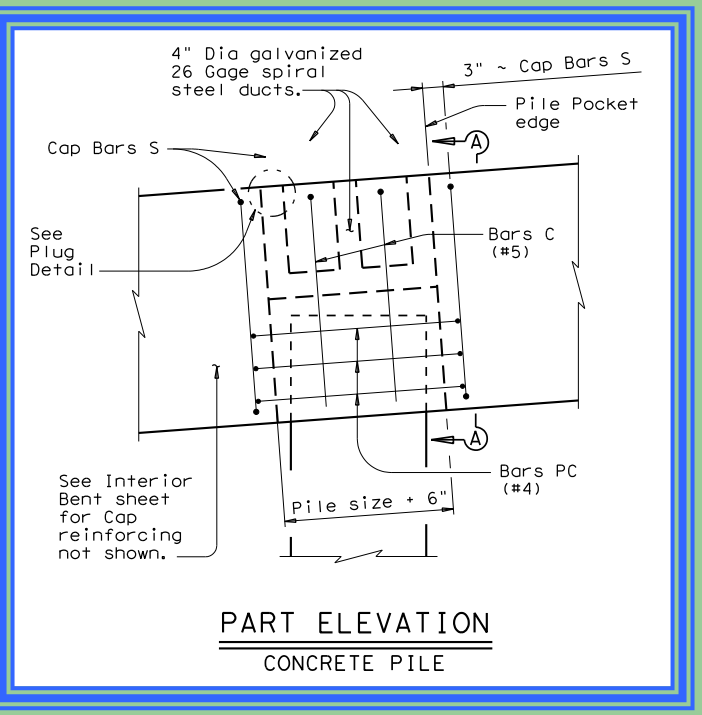
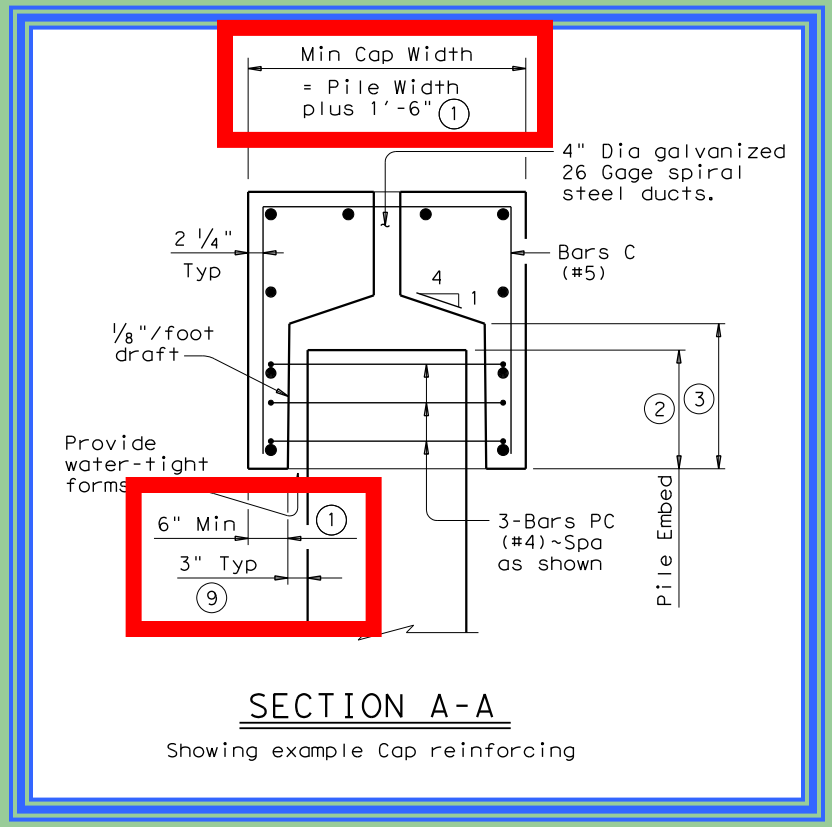


PART PLAN
CONCRETE PILE



PART ELEVATION
CONCRETE PILE



SECTION A-A
Showing example Cap reinforcing

1. Provide wider cap if necessary. Adjust cap bars S dimensions accordingly. All quantity adjustments are at the Contractor's expense.
2. 1'-0" (+2 1/2", -0") with 16" and 18" piles;
   1'-6" (+2 1/2", -0") with 20" and 24" piles
3. 1'-3" with 16" and 18" piles;
   1'-9" with 20" and 24" piles

PBC-P

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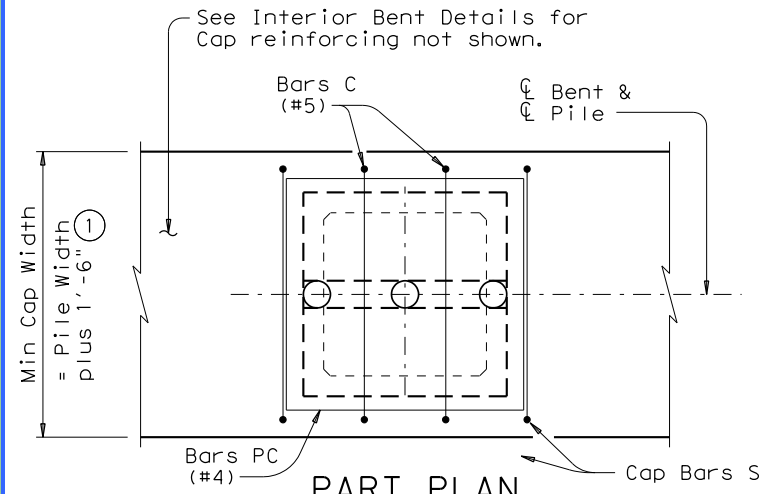
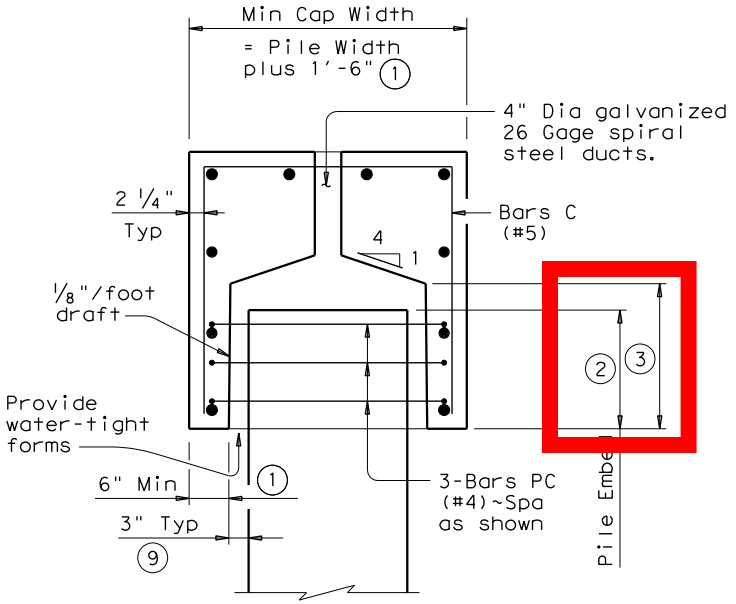
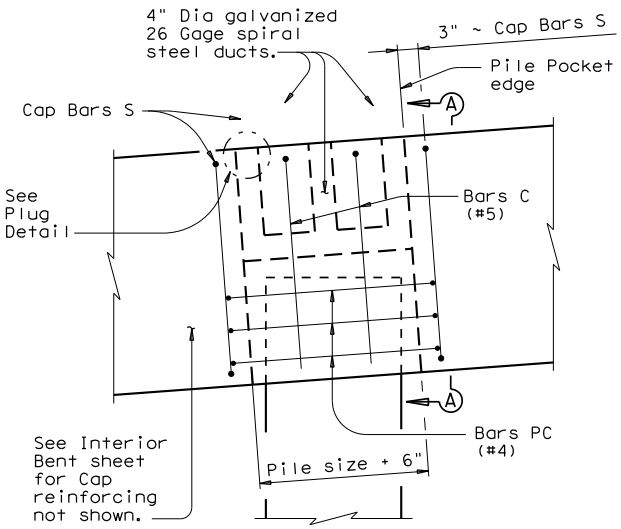


PART PLAN
CONCRETE PILE



SECTION A-A
Showing example Cap reinforcing



PART ELEVATION
CONCRETE PILE

(1) Provide wider cap if necessary. Adjust cap bars S dimensions accordingly. All quantity adjustments are at the Contractor's expense.

(2) 1'-0" (+2 1/2", -0") with 16" and 18" piles;
1'-6" (+2 1/2", -0") with 20" and 24" piles

(3) 1'-3" with 16" and 18" piles;
1'-9" with 20" and 24" piles

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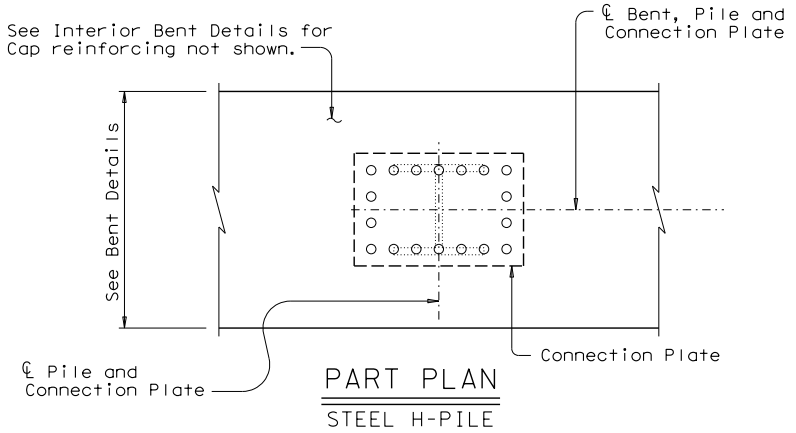
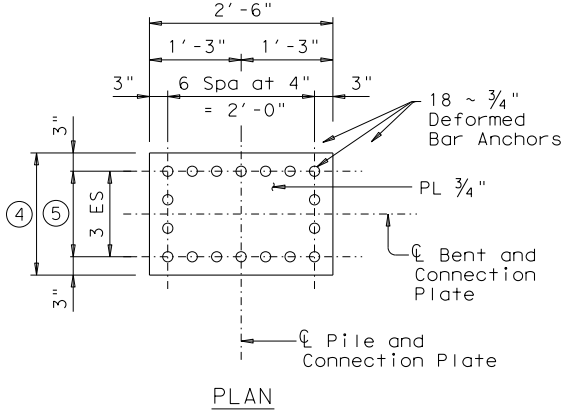


PART PLAN

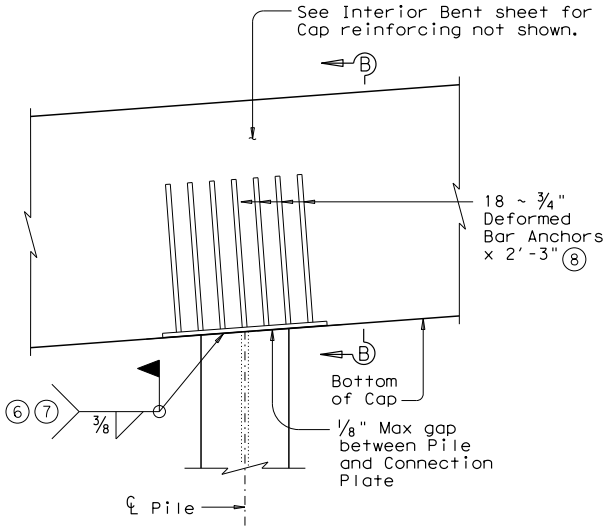
STEEL H-PILE



PLAN

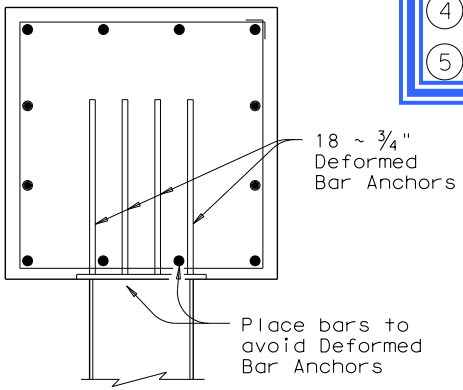
CONNECTION PLATE DETAIL

Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION

STEEL H-PILE



SECTION B-B

Showing example Cap reinforcing

4 Pile size plus 6"

5 Pile size (Example: 1′-2" for HP14)

7 A certified welder is required.

8 If Cap height is less than 2′-9", Deformed Bar Anchor length is 6" less than Cap height.

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR [illegible] AND STEEL H-PILES

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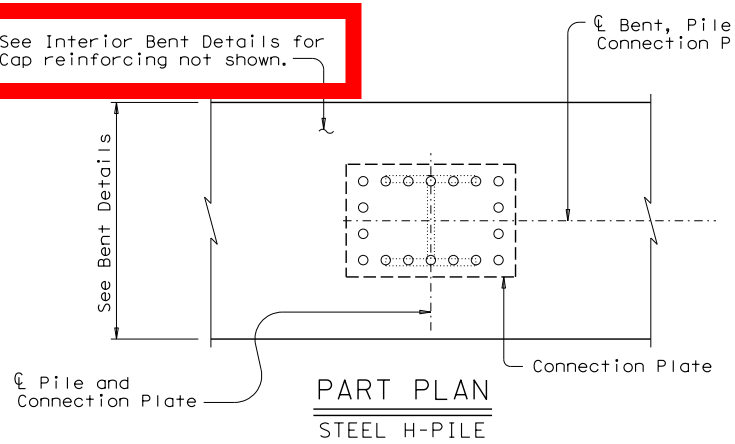
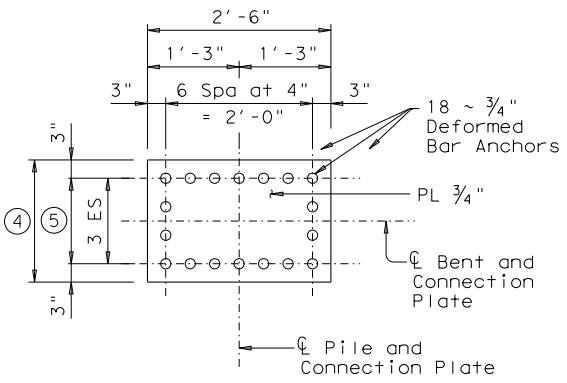
See Interior Bent Details for Cap reinforcing not shown.



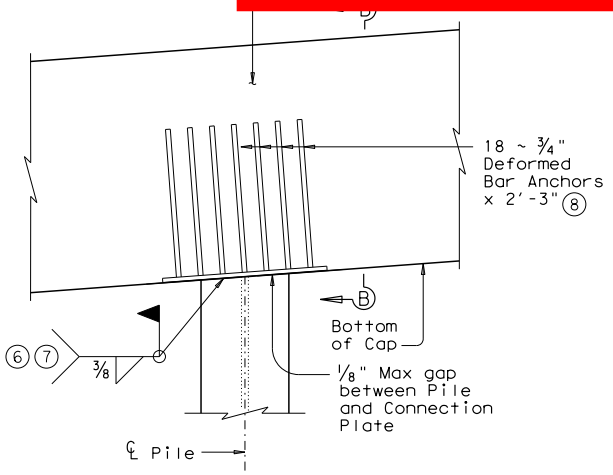
PART PLAN
STEEL H-PILE



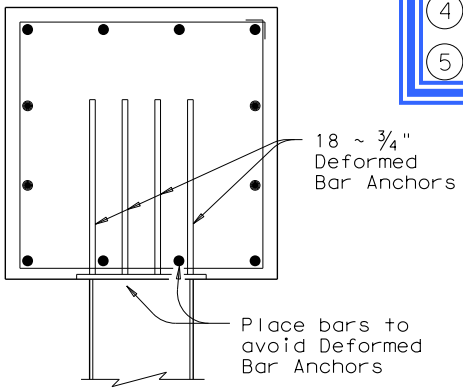
PLAN

CONNECTION PLATE DETAIL
Electric arc end weld deformed bar anchors with complete fusion.

See Interior Bent sheet for Cap reinforcing not shown.



PART ELEVATION
STEEL H-PILE



SECTION B-B
Showing example Cap reinforcing

4 Pile size plus 6"

5 Pile size (Example: 1′-2" for HP14)

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR [illegible] AND STEEL H-PILES

PBC-P

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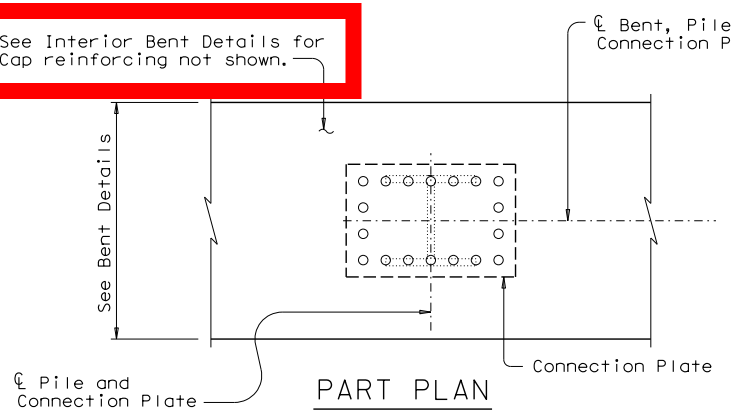
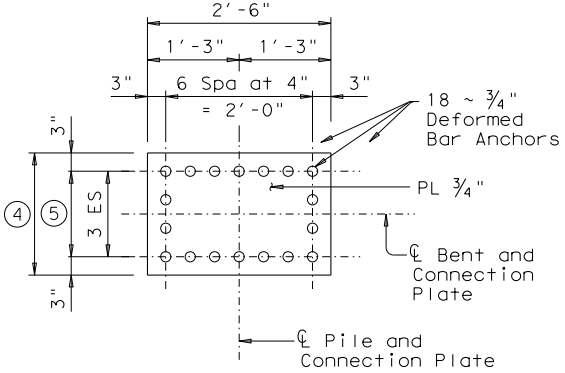
7 A certified welder is required.

8 If Cap height is less than 2′-9", Deformed Bar Anchor length is 6" less than Cap height.

See Interior Bent Details for Cap reinforcing not shown.



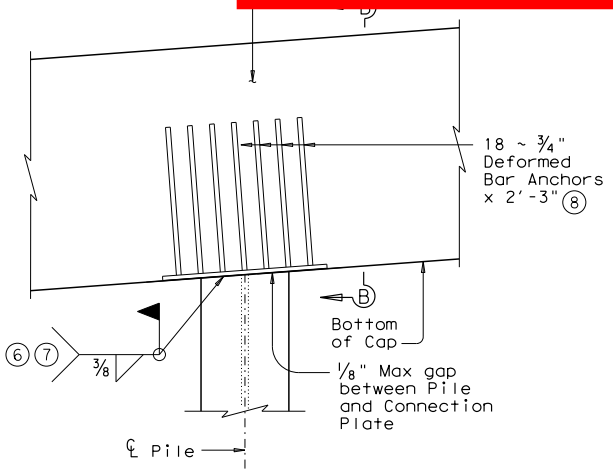
PART PLAN
STEEL H-PILE



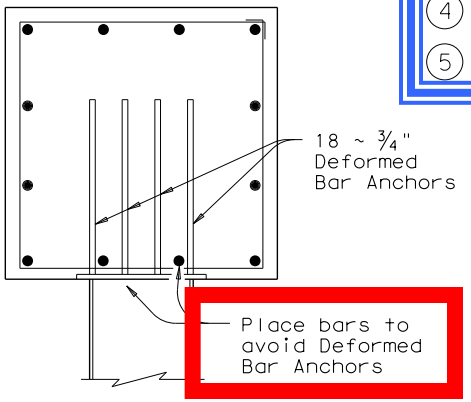
PLAN

CONNECTION PLATE DETAIL
Electric arc end weld deformed bar anchors with complete fusion.

See Interior Bent sheet for Cap reinforcing not shown.



PART ELEVATION
STEEL H-PILE



SECTION B-B
Showing example Cap reinforcing

(4) Pile size plus 6"

(5) Pile size (Example: 1′-2" for HP14)

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

PBC-P

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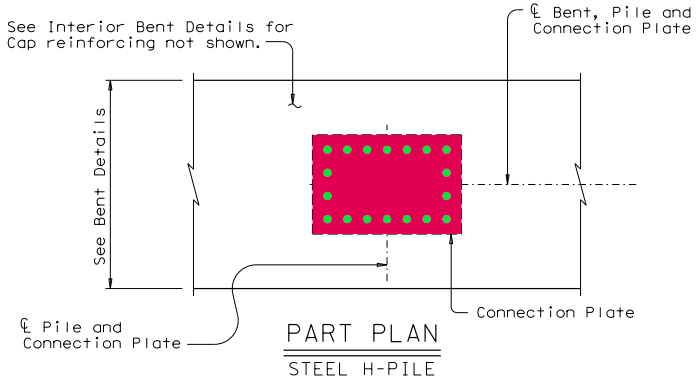
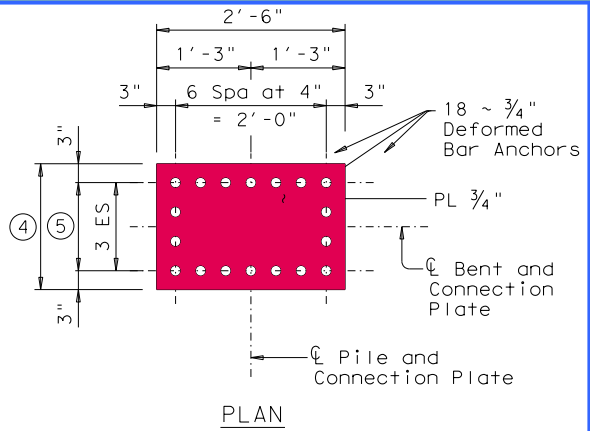
(7) A certified welder is required.

(8) If Cap height is less than 2′-9", Deformed Bar Anchor length is 6" less than Cap height.



PART PLAN

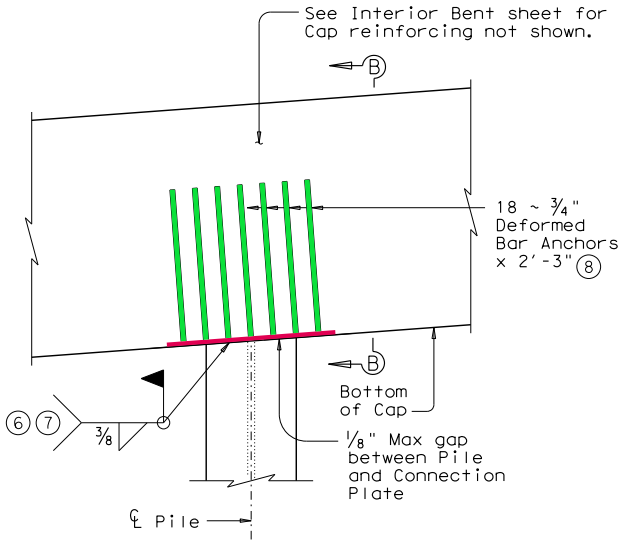
STEEL H-PILE



PLAN

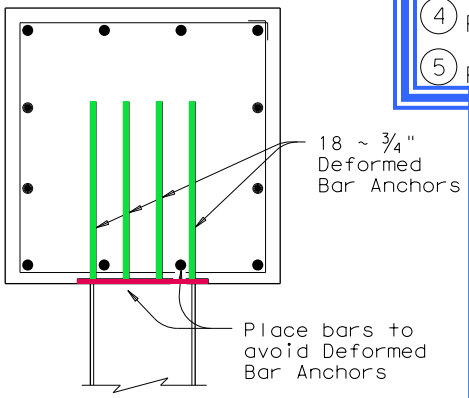
CONNECTION PLATE DETAIL

Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION

STEEL H-PILE



SECTION B-B

Showing example Cap reinforcing

(4) Pile size plus 6"

(5) Pile size (Example: 1′-2" for HP14)

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Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

PBC-P

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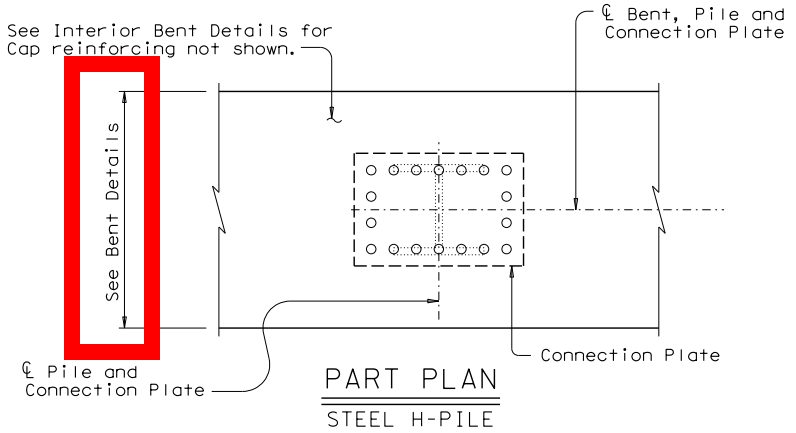
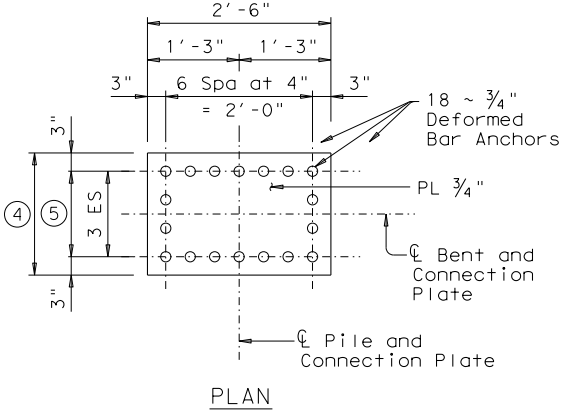
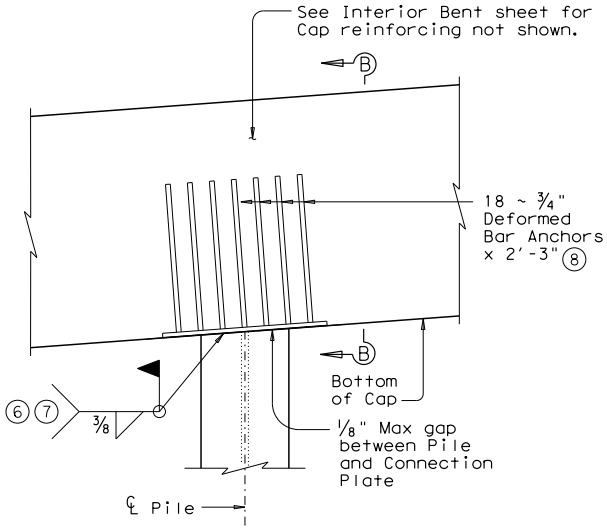


PART PLAN
STEEL H-PILE

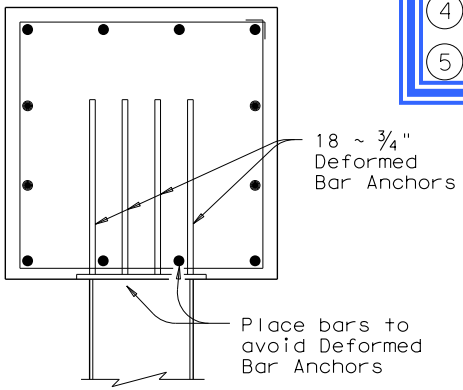


PLAN

CONNECTION PLATE DETAIL
Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION
STEEL H-PILE



SECTION B-B
Showing example Cap reinforcing

4 Pile size plus 6"

5 Pile size (Example: 1′-2" for HP14)

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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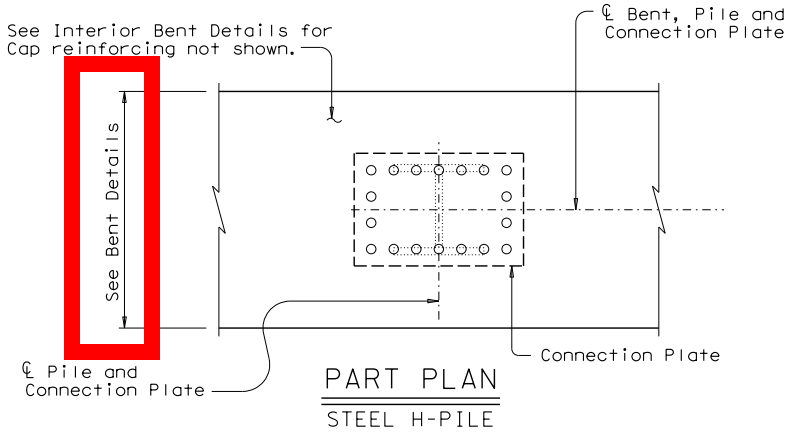
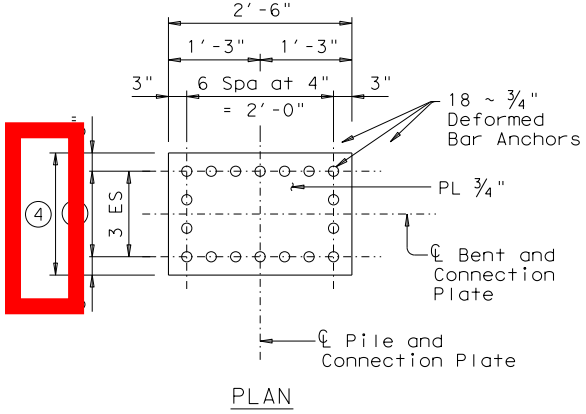
7 A certified welder is required.

8 If Cap height is less than 2′-9", Deformed Bar Anchor length is 6" less than Cap height.



PART PLAN

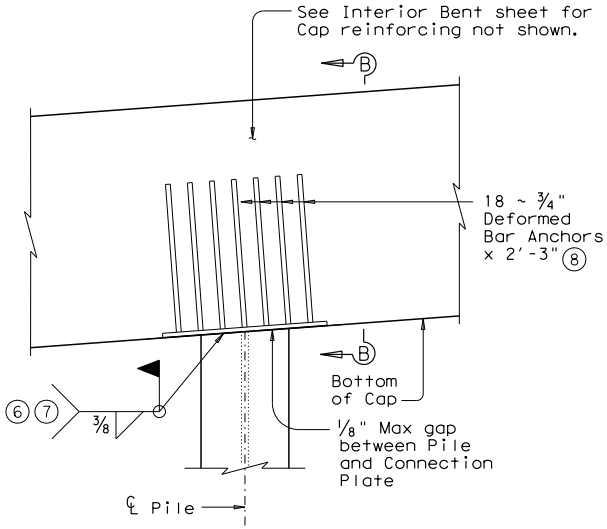
STEEL H-PILE



PLAN

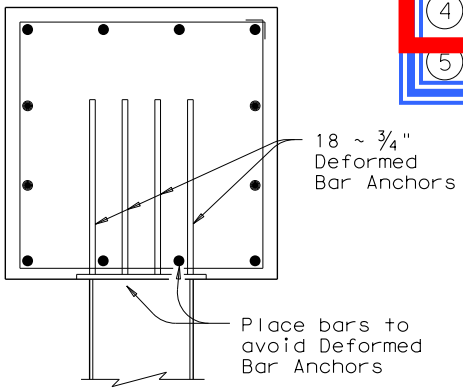
CONNECTION PLATE DETAIL

Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION

STEEL H-PILE



SECTION B-B

Showing example Cap reinforcing

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Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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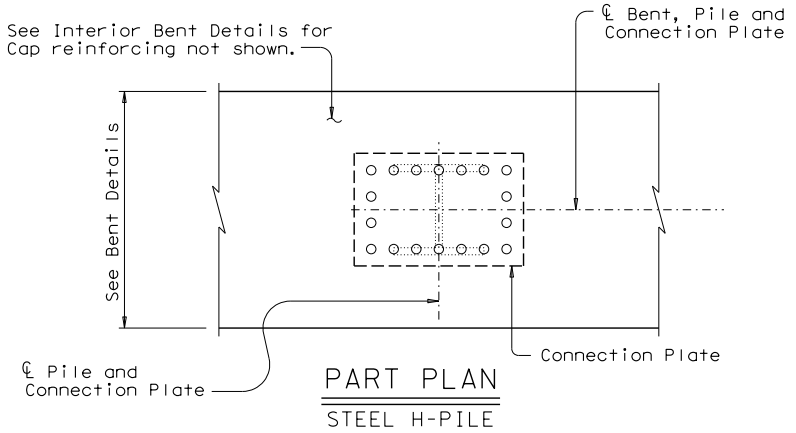
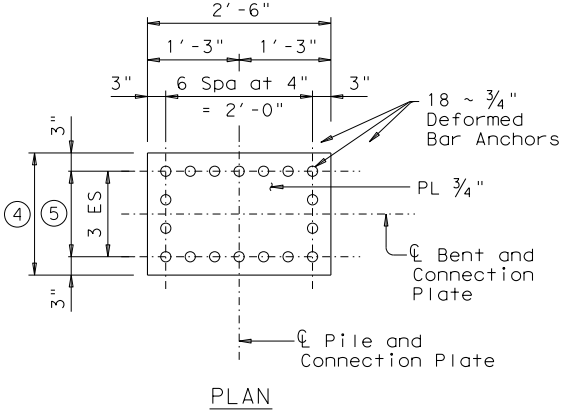


PART PLAN

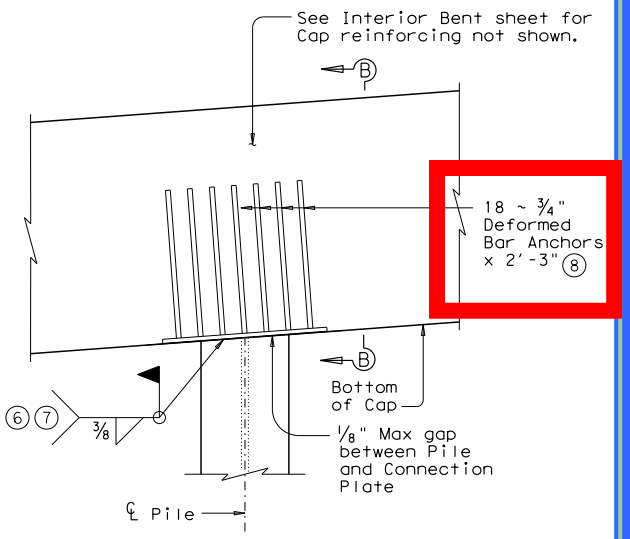
STEEL H-PILE



PLAN

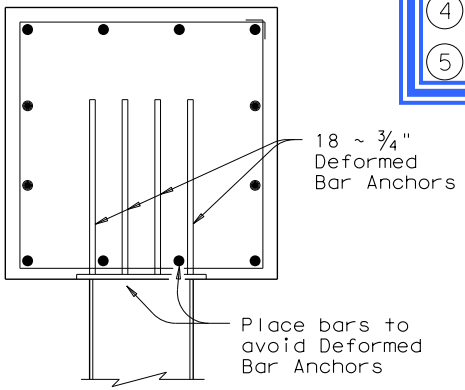
CONNECTION PLATE DETAIL

Electric arc end weld deformed bar anchors with complete fusion.



PART ELEVATION

STEEL H-PILE



SECTION B-B

Showing example Cap reinforcing

4 Pile size plus 6"

5 Pile size (Example: 1′-2" for HP14)

Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

PBC-P

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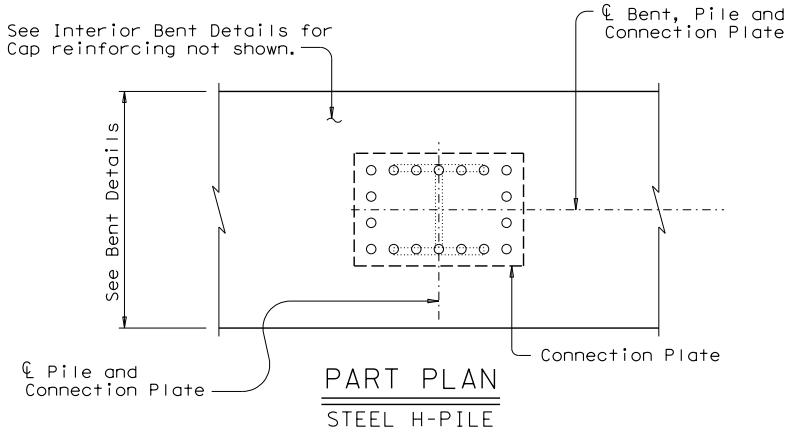
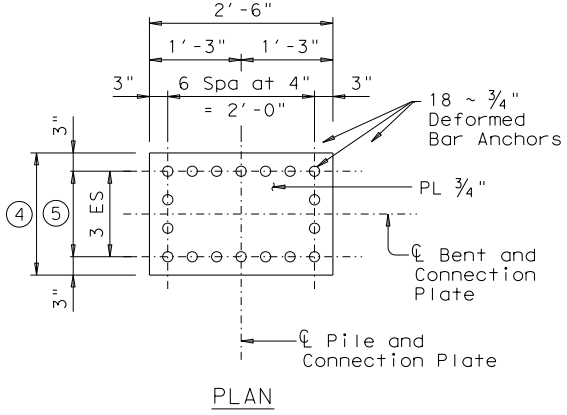


PART PLAN

STEEL H-PILE



PLAN

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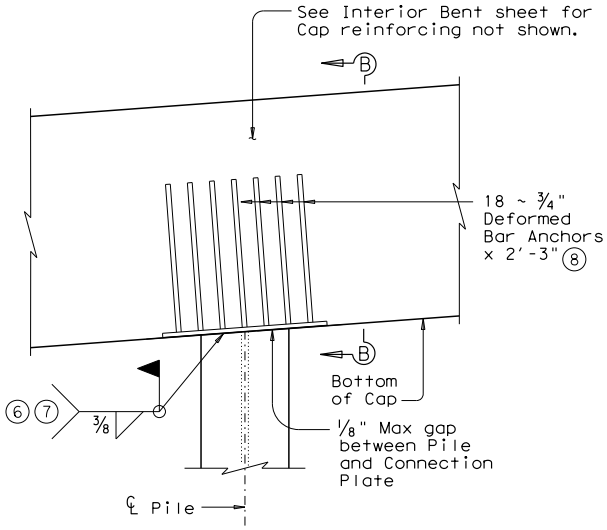
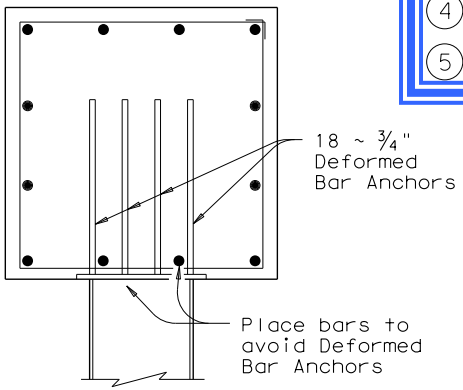


PART ELEVATION

STEEL H-PILE



SECTION B-B

Showing example Cap reinforcing

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Texas Department of Transportation

Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

PBC-P

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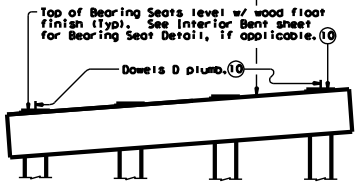
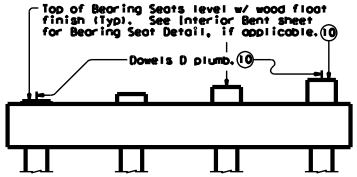
TABLE OF GROUT SPECIFICATIONS		
PROPERTY	VALUES	SAMPLING AND TESTING
Mechanical		
Compressive Strength	2,500 psi, beam placement 5,800 psi, 28 days	ASTM C109 (Modified by C1107) Three cubes, Min, for beam placement strength Three cubes, Min, for final 28-day strength Per Bent (All samples must meet or exceed requirements)
Constructability		
Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions

Slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET AT SLOPE

Reinforce bearing seats over 3" tall and slope top of cap between bearing seats in accordance with Item 420.4 "Treatment and Finishing of Horizontal Surfaces Other Than Bridge Slabs", unless directed otherwise by the Engineer.



CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

(10) Unless otherwise shown

GROUTING NOTES FOR CONCRETE PILES:

Make a trial batch of grout using the same material, equipment and personnel to be used for actual grouting operations and grout a mock-up of the connection at least one week before grouting and in the presence of the Engineer. This mock-up test must demonstrate the reliability of the Contractor's grouting procedures to provide a connection free of voids. Field test the trial batch grout to the same level required for the actual grouting.

Surfaces in contact with grout must be clean and in a saturated, surface-dry condition, immediately prior to grouting. Provide water tight forms. Fill the forms with water and drain just prior to grouting. Ponding or free-standing water is not permitted. Use compressed air to blow out excess water.

Mix grout in accordance with the manufacturer's directions. Evidence of frothing, foaming, or segregation is cause for rejection. Transport grout from mixer to final location by wheel barrow, bucket or pumping.

Perform sampling and testing of grout by trained personnel at the Contractor's expense and while witnessed by the Engineer. Grouted connections must be free of voids.

Trowel finish top surface of cap anchorage ducts flush with top of cap. Wet mat cure these locations for at least 48 hours. When lifting loops are removed, remove them to a point 1" below cap surface and patch with an approved material.

Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

WELDING NOTES FOR STEEL H-PILES:

After field welding is complete, clean and paint top of pile and connection plate as specified in Item 407.3.8.

Beams may be set on Cap after all Cap to Pile welds are complete.

CONSTRUCTION NOTES:

Submit shop drawings of precast caps for approval prior to construction. Indicate lifting attachments and locations on the shop drawings.

Construct and cure cap in accordance with Item 420, "Concrete Structures". Secure ducts, pile pockets and connection plates to prevent their movement during concrete placement. Location tolerance of ducts, pile pockets and connection plates is 1/4" from plan location, transversely and longitudinally. Seal ducts and pile pockets to prevent intrusion of concrete.

Bearing seats may be precast with the cap. Bearing seats over 3" in height must be reinforced as per Item 420.4.H. Do not locate lift points at bearing seats if bearing seats are precast.

Cap concrete must achieve a compressive strength of 2500 psi prior to lifting. Limit flexural stress in cap to 250 psi during handling and storage. Store and handle caps in accordance with Item 424, "Precast Concrete Structures (Fabrication)". Do not stack caps. Caps that become cracked or otherwise damaged may be rejected.

Top of piling may be no more than 2" from plan location, both transverse and longitudinal to bent centerline, after driving.

MATERIAL NOTES:

Provide prepackaged, cementitious, non-shrink grout conforming to ASTM C1107 Allowable grouts include BASF Masterflow 928, SikaGrout 212, and Euclid Hi-Flow, although grout selected must further meet the additional performance requirements listed in the Table of Grout Performance Specifications and any other requirement listed elsewhere. In case of conflict between ASTM C1107 and the listed requirements, the listed requirements govern. Do not use grouts using metallic formulations or with chlorides. No additives to the grout are permitted.

Provide semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

Provide deformed bar anchors conforming to ASTM A496 and connection plates conforming to ASTM A36.

GENERAL NOTES:

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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TABLE OF GROUT SPECIFICATIONS		
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Flowability	Fluid Consistency Efflux Time 20-30 Seconds	Test Method Tex-437-A One test Min per Bent, and as needed to calibrate mix proportions

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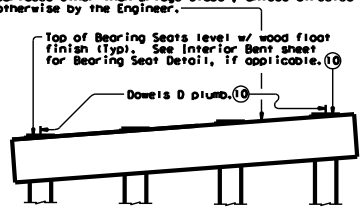

CAP SET AT SLOPE

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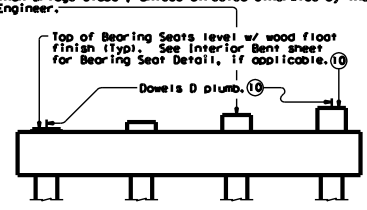

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

(10) Unless otherwise shown

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Friction collars may be removed, if used, and beams placed on the cap after the grout obtains a compressive strength of 2500 psi. Subsequent loading can occur when the grout reaches its final required 28 day compressive strength.

WELDING NOTES FOR STEEL H-PILES:

After field welding is complete, clean and paint top of pile and connection plate as specified in Item 407.3.8.

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Provide semi-rigid spirally crimped, corrugated duct of galvanized, cold rolled steel conforming to ASTM A 653. Corrugations must have a minimum amplitude of 0.094".

Grout tubes and forms must be approved prior to grouting.

Provide deformed bar anchors conforming to ASTM A496 and connection plates conforming to ASTM A36.

GENERAL NOTES:

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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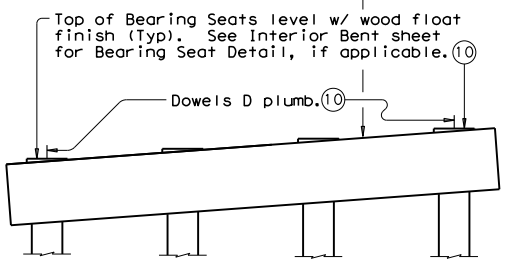

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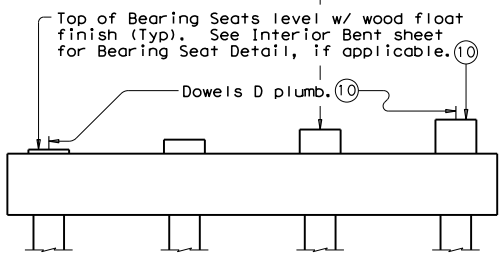

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

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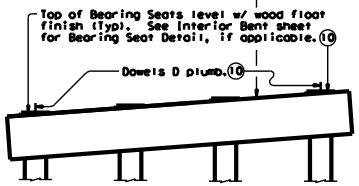

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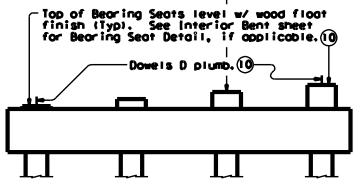

CAP SET LEVEL

EXAMPLES OF PRECAST BENTS WITH DOWELS D

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Grout tubes and forms must be approved prior to grouting.

Provide deformed bar anchors conforming to ASTM A496 and connection plates conforming to ASTM A36.

GENERAL NOTES:

Designed in accordance with AASHTO LRFD Bridge Design Specifications.

Texas Department of Transportation
Bridge Division

PRECAST CONCRETE BENT CAP OPTION FOR CONCRETE PILES AND STEEL H-PILES

PBC-P

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Notes: (Construction/Material/General)

- Same as the round column standard except:
- Place beams after all pile welds are complete
- Clean and Paint top of pile and connection plate

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - **Grout Mock Up**
  - Placing Cap
- Using the Standards
  - Do's and Don'ts
  - Location of Standard Drawings
- Questions

Grouting Issues

Clumps

Segregation

Air Voids

Grout Pump

Flow Cone Grout Test (Water)

Flow Cone Grout Test (Grout)

Placing Friction Collar

Placing “Cap”

Mock Set Up

Grout Pump Connection

Grouting

Mock Set Up

Grout Pump Connection

Grouting

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - **Placing Cap**
- Using the Standards
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- Questions

Steel Ducts in Cap

Lifting Interior Bent

Placing Cap on Round Columns

Grouting using a Pressure Pump

Grout Placement Techniques

Tremie Tube

Pressure Pump

Interior Bent on
Steel H-Piles

Interior Bent on
Steel H-Piles

Pile Pocket

Interior Bent on Concrete Piles

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
  - **Do's and Don'ts**
  - Location of Standard Drawings
- Questions

Do's

- Recommended with standard interior bents
  - No adjustments to quantities, or special specifications are required
- Conventional multi-column bents
  - Rectangular bent
  - Column Spacing < 18ft
  - Standard span lengths
- Pan Forms on Steel Piles

Don’ts

- NO Pan forms on concrete piles (PBC-P not valid)
- Heavily reinforced bent caps
- Inverted Tee bent caps
- Extra long bent caps

Things to Consider

When using with a non-standard bent cap

- Lifting Weights ~ Max 80-100kips
- Verify reinforcement clearances
- Evaluate connection stresses
- Column Spacing
- Span Lengths
- Minimum Bent Cap Dimensions

Precast Bent Cap Standards

- Standard Drawings
  - Background
  - Round Columns (PBC-RC)
  - Piles (Concrete and H-Piles) (PBC-P)
- Construction
  - Grout Mock Up
  - Placing Cap
- Using the Standards
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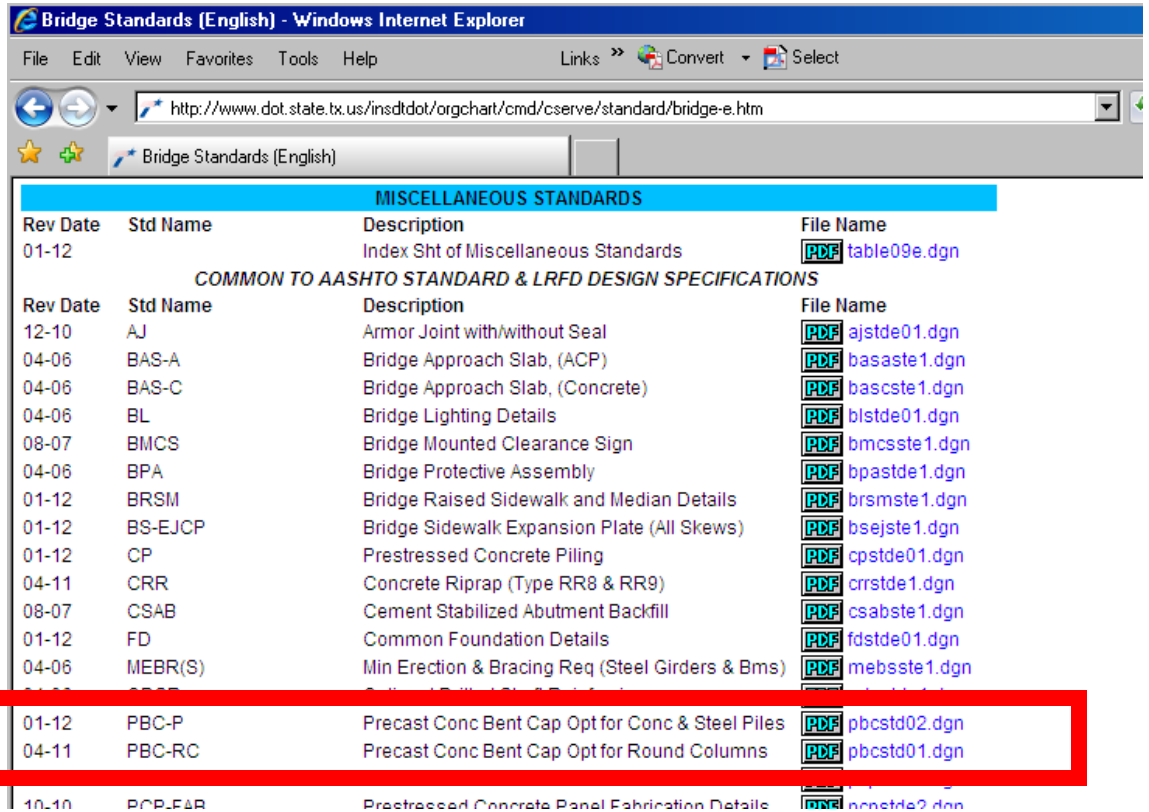
  - **Location of Standard Drawings**
- Questions

Bridge Standard Website:

http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/bridge-e.htm



MISCELLANEOUS STANDARDS

Rev Date	Std Name	Description	File Name
01-12		Index Sht of Miscellaneous Standards	table09e.dgn

COMMON TO AASHTO STANDARD & LRFD DESIGN SPECIFICATIONS

Rev Date	Std Name	Description	File Name
12-10	AJ	Armor Joint with/without Seal	ajstde01.dgn
04-06	BAS-A	Bridge Approach Slab, (ACP)	basaste1.dgn
04-06	BAS-C	Bridge Approach Slab, (Concrete)	bascste1.dgn
04-06	BL	Bridge Lighting Details	blstde01.dgn
08-07	BMCS	Bridge Mounted Clearance Sign	bmcsste1.dgn
04-06	BPA	Bridge Protective Assembly	bpastde1.dgn
01-12	BRSM	Bridge Raised Sidewalk and Median Details	brsmste1.dgn
01-12	BS-EJCP	Bridge Sidewalk Expansion Plate (All Skews)	bsejste1.dgn
01-12	CP	Prestressed Concrete Piling	cpstde01.dgn
04-11	CRR	Concrete Riprap (Type RR8 & RR9)	crrstde1.dgn
08-07	CSAB	Cement Stabilized Abutment Backfill	csabste1.dgn
01-12	FD	Common Foundation Details	fdstde01.dgn
04-06	MEBR(S)	Min Erection & Bracing Req (Steel Girders & Bms)	mebsste1.dgn
01-12	PBC-P	Precast Conc Bent Cap Opt for Conc & Steel Piles	pbcstd02.dgn
04-11	PBC-RC	Precast Conc Bent Cap Opt for Round Columns	pbcstd01.dgn

In Conclusion…

The “Precast Concrete Bent Cap Option” Standards EXIST

They are SIMPLE to USE…

so don’t be INTIMIDATED

Use of these standards is NOT mandatory

- Districts can disallow the use of precast bent caps
  - Include a note in the General Notes Item 420

When used…

They only supply a construction method OPTION

– Like PMDF vs. PCP

QUESTIONS?

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